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EASTERN—WESTERN ARCTIC SEA ICE ANALYSIS

1987

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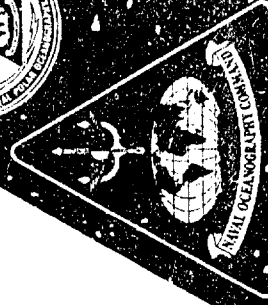
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PREPARED BY
NAVAL POLAR OCEANOGRAPHY CENTER
SUITLAND, MD

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FOREWORD

Since 1976, the U.S. Navy and the National Oceanic and Atmospheric Administration (NOAA) have sponsored the Navy/NOAA Joint Ice Center (JIC) in Suitland, Maryland. The JIC has built upon the long experience of the Navy in observing and recording sea ice information, and NOAA's expertise in satellite data collection and interpretation. By combining resources, the Navy and NOAA have kept pace with the increasing requirements for Arctic and Antarctic information from all sectors of society.

This publication is the fourteenth annual compilation of satellite photographic products, limited aerial reconnaissance and other conventional observations. The JIC would like to thank the Atmospheric Environment Service, Canada, for their support in aerial reconnaissance of the Canadian Archipelago, Beaufort Sea, and the Great Lakes; and the observers of the stations bordering the Baltic Sea for their timely data. Thanks are also extended to those observers who endeavored to send JIC their ice observations from ships, planes, and shore stations. The Great Lakes analyses were aided by National Weather Service data collection and analyses performed at the Ann Arbor, Michigan, Forecast Office; and, beginning in December 1987, the Cleveland, Ohio, Forecast Office. All these data were incorporated into the weekly analyses and significantly improved the quality of the final products.

Table I, inside back cover, summarizes the satellite data available during 1987.

The ice charts contained in this atlas were derived from a manual synthesis of sea ice data received by the JIC.

Analyses were performed by trained Navy and NOAA personnel, but limitations in the data, primarily resolution and wavelength (implying cloud limitations), strongly influenced the analysis methodology and accuracy of the product. The following analysis procedure was used:

- a. Conventional shore station, ship, and aerial reconnaissance data were evaluated and plotted on base charts.
- b. NOAA polar orbiter, NASA Nimbus 7 SMMR, GEOSAT altimeter, DMSP visual, and SSM/I data were gridded and manually interpreted for sea ice conditions.
- c. A final product was produced from a. and b. wherever sufficient data existed; otherwise, meteorological data and ice drift data (derived from forecast meteorological fields) were incorporated to estimate the ice edge.

Navy/NOAA Joint Ice Center
Naval Polar Oceanography Center
4301 Suitland Road
Washington, DC 20390-5180

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) EASTERN-WESTERN ARCTIC SEA ICE ANALYSIS 1987		5. TYPE OF REPORT & PERIOD COVERED Reference Report 1987
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND, MD		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Oceanography Command Detachment Federal Building Asheville, NC 28801-2696		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Commanding Officer Fleet Numerical Oceanography Center Monterey, CA 93943-5005		12. REPORT DATE
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approval for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Sea ice; polar ice fields; satellite imagery; concentration; stage of development; fast ice; concentration of thickness; theoretical thickness, Arctic		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) These are approximately 7-days analysis of sea ice prepared by the Naval Polar Oceanography Center, Suitland, MD. Included are ice concentration and ice thickness (age). Area covered:		

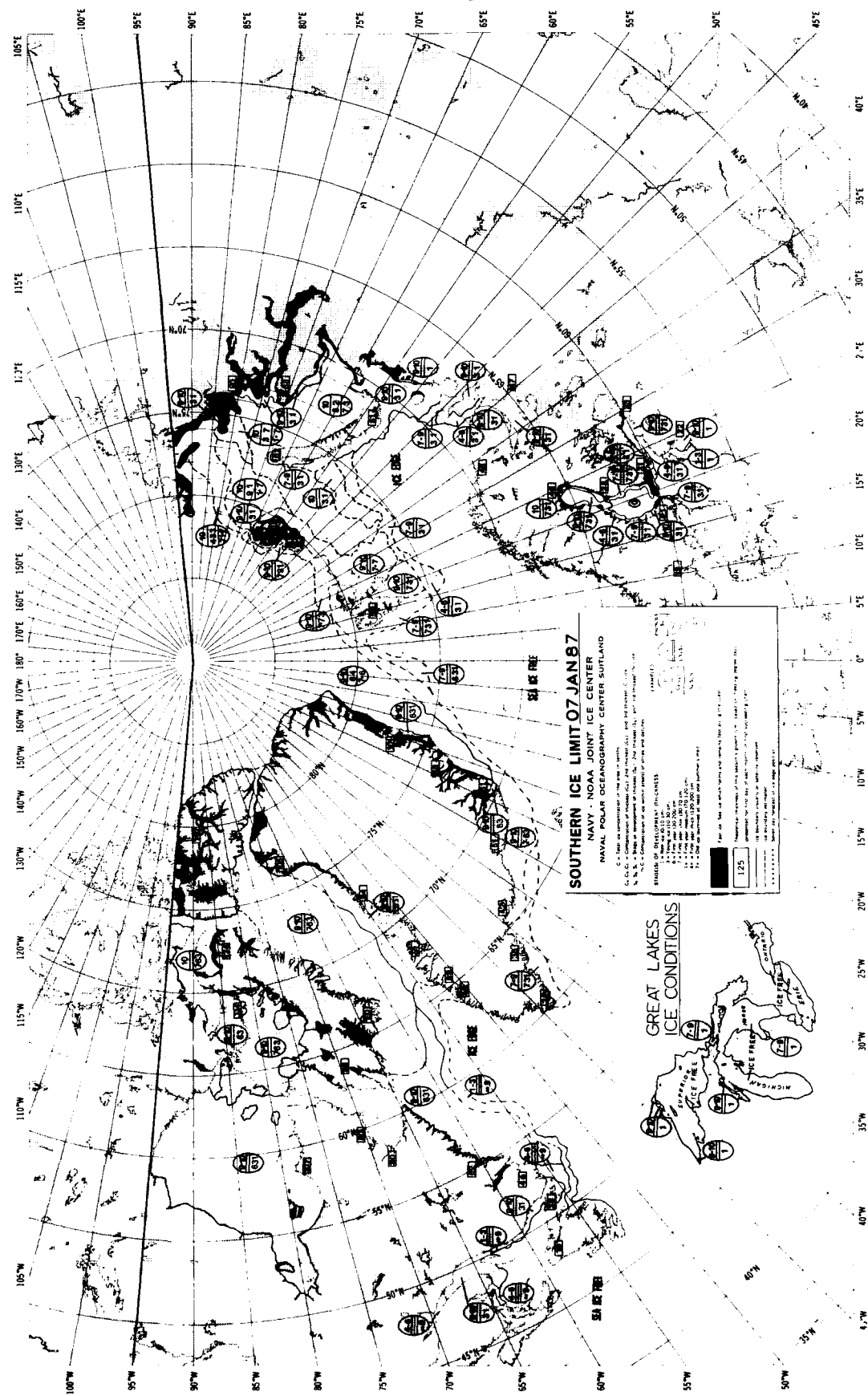
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SOUTHERN ICE LIMIT 07 JAN 87

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Total ice concentration at the area in question
Concentration of ethane (C_E) and methane (C_M) = 10%

Stages of development of the cases (Fig. 2). The threshold (S_{th}) is not indicated in the diagram.

a. Mean age 10-10 cm.
 b. Young size 110-30 cm.
 c. Female size 130-200 cm.
 d. Male size 130-200 cm.

Q Did you do anything at night after bedtime?

Page 40 has no article terms and remains Page 40. (19-100)

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1500-1510 1510-1520 1520-1530 1530-1540 1540-1550 1550-1560 1560-1570 1570-1580 1580-1590 1590-1600 1600-1610 1610-1620 1620-1630 1630-1640 1640-1650 1650-1660 1660-1670 1670-1680 1680-1690 1690-1700 1700-1710 1710-1720 1720-1730 1730-1740 1740-1750 1750-1760 1760-1770 1770-1780 1780-1790 1790-1800 1800-1810 1810-1820 1820-1830 1830-1840 1840-1850 1850-1860 1860-1870 1870-1880 1880-1890 1890-1900 1900-1910 1910-1920 1920-1930 1930-1940 1940-1950 1950-1960 1960-1970 1970-1980 1980-1990 1990-2000 2000-2010 2010-2020 2020-2030 2030-2040 2040-2050 2050-2060 2060-2070 2070-2080 2080-2090 2090-2100 2100-2110 2110-2120 2120-2130 2130-2140 2140-2150 2150-2160 2160-2170 2170-2180 2180-2190 2190-2200 2200-2210 2210-2220 2220-2230 2230-2240 2240-2250 2250-2260 2260-2270 2270-2280 2280-2290 2290-2300 2300-2310 2310-2320 2320-2330 2330-2340 2340-2350 2350-2360 2360-2370 2370-2380 2380-2390 2390-2400 2400-2410 2410-2420 2420-2430 2430-2440 2440-2450 2450-2460 2460-2470 2470-2480 2480-2490 2490-2500 2500-2510 2510-2520 2520-2530 2530-2540 2540-2550 2550-2560 2560-2570 2570-2580 2580-2590 2590-2600 2600-2610 2610-2620 2620-2630 2630-2640 2640-2650 2650-2660 2660-2670 2670-2680 2680-2690 2690-2700 2700-2710 2710-2720 2720-2730 2730-2740 2740-2750 2750-2760 2760-2770 2770-2780 2780-2790 2790-2800 2800-2810 2810-2820 2820-2830 2830-2840 2840-2850 2850-2860 2860-2870 2870-2880 2880-2890 2890-2900 2900-2910 2910-2920 2920-2930 2930-2940 2940-2950 2950-2960 2960-2970 2970-2980 2980-2990 2990-3000 3000-3010 3010-3020 3020-3030 3030-3040 3040-3050 3050-3060 3060-3070 3070-3080 3080-3090 3090-3100 3100-3110 3110-3120 3120-3130 3130-3140 3140-3150 3150-3160 3160-3170 3170-3180 3180-3190 3190-3200 3200-3210 3210-3220 3220-3230 3230-3240 3240-3250 3250-3260 3260-3270 3270-3280 3280-3290 3290-3300 3300-3310 3310-3320 3320-3330 3330-3340 3340-3350 3350-3360 3360-3370 3370-3380 3380-3390 3390-3400 3400-3410 3410-3420 3420-3430 3430-3440 3440-3450 3450-3460 3460-3470 3470-3480 3480-3490 3490-3500 3500-3510 3510-3520 3520-3530 3530-3540 3540-3550 3550-3560 3560-3570 3570-3580 3580-3590 3590-3600 3600-3610 3610-3620 3620-3630 3630-3640 3640-3650 3650-3660 3660-3670 3670-3680 3680-3690 3690-3700 3700-3710 3710-3720 3720-3730 3730-3740 3740-3750 3750-3760 3760-3770 3770-3780 3780-3790 3790-3800 3800-3810 3810-3820 3820-3830 3830-3840 3840-3850 3850-3860 3860-3870 3870-3880 3880-3890 3890-3900 3900-3910 3910-3920 3920-3930 3930-3940 3940-3950 3950-3960 3960-3970 3970-3980 3980-3990 3990-4000 4000-4010 4010-4020 4020-4030 4030-4040 4040-4050 4050-4060 4060-4070 4070-4080 4080-4090 4090-4100 4100-4110 4110-4120 4120-4130 4130-4140 4140-4150 4150-4160 4160-4170 4170-4180 4180-4190 4190-4200 4200-4210 4210-4220 4220-4230 4230-4240 4240-4250 4250-4260 4260-4270 4270-4280 4280-4290 4290-4300 4300-4310 4310-4320 4320-4330 4330-4340 4340-4350 4350-4360 4360-4370 4370-4380 4380-4390 4390-4400 4400-4410 4410-4420 4420-4430 4430-4440 4440-4450 4450-4460 4460-4470 4470-4480 4480-4490 4490-4500 4500-4510 4510-4520 4520-4530 4530-4540 4540-4550 4550-4560 4560-4570 4570-4580 4580-4590 4590-4600 4600-4610 4610-4620 4620-4630 4630-4640 4640-4650 4650-4660 4660-4670 4670-4680 4680-4690 4690-4700 4700-4710 4710-4720 4720-4730 4730-4740 4740-4750 4750-4760 4760-4770 4770-4780 4780-4790 4790-4800 4800-4810 4810-4820 4820-4830 4830-4840 4840-4850 4850-4860 4860-4870 4870-4880 4880-4890 4890-4900 4900-4910 4910-4920 4920-4930 4930-4940 4940-4950 4950-4960 4960-4970 4970-4980 4980-4990 4990-5000 5000-5010 5010-5020 5020-5030 5030-5040 5040-5050 5050-5060 5060-5070 5070-5080 5080-5090 5090-5100 5100-5110 5110-5120 5120-5130 5130-5140 5140-5150 5150-5160 5160-5170 5170-5180 5180-5190 5190-5200 5200-5210 5210-5220 5220-5230 5230-5240 5240-5250 5250-5260 5260-5270 5270-5280 5280-5290 5290-5300 5300-5310 5310-5320 5320-5330 5330-5340 5340-5350 5350-5360 5360-5370 5370-5380 5380-5390 5390-5400 5400-5410 5410-5420 5420-5430 5430-5440 5440-5450 5450-5460 5460-5470 5470-5480 5480-5490 5490-5500 5500-5510 5510-5520 5520-5530 5530-5540 5540-5550 5550-5560 5560-5570 5570-5580 5580-5590 5590

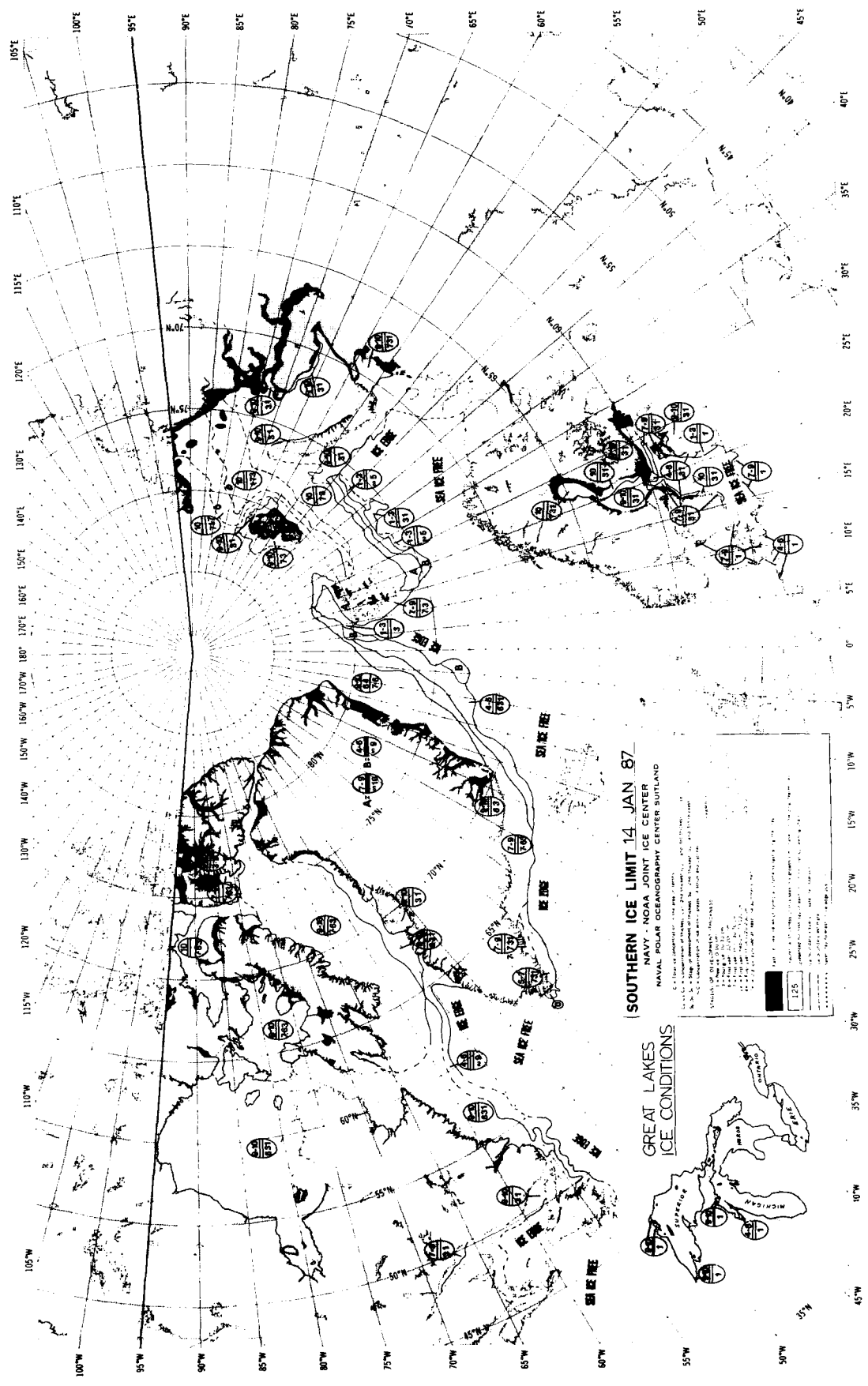
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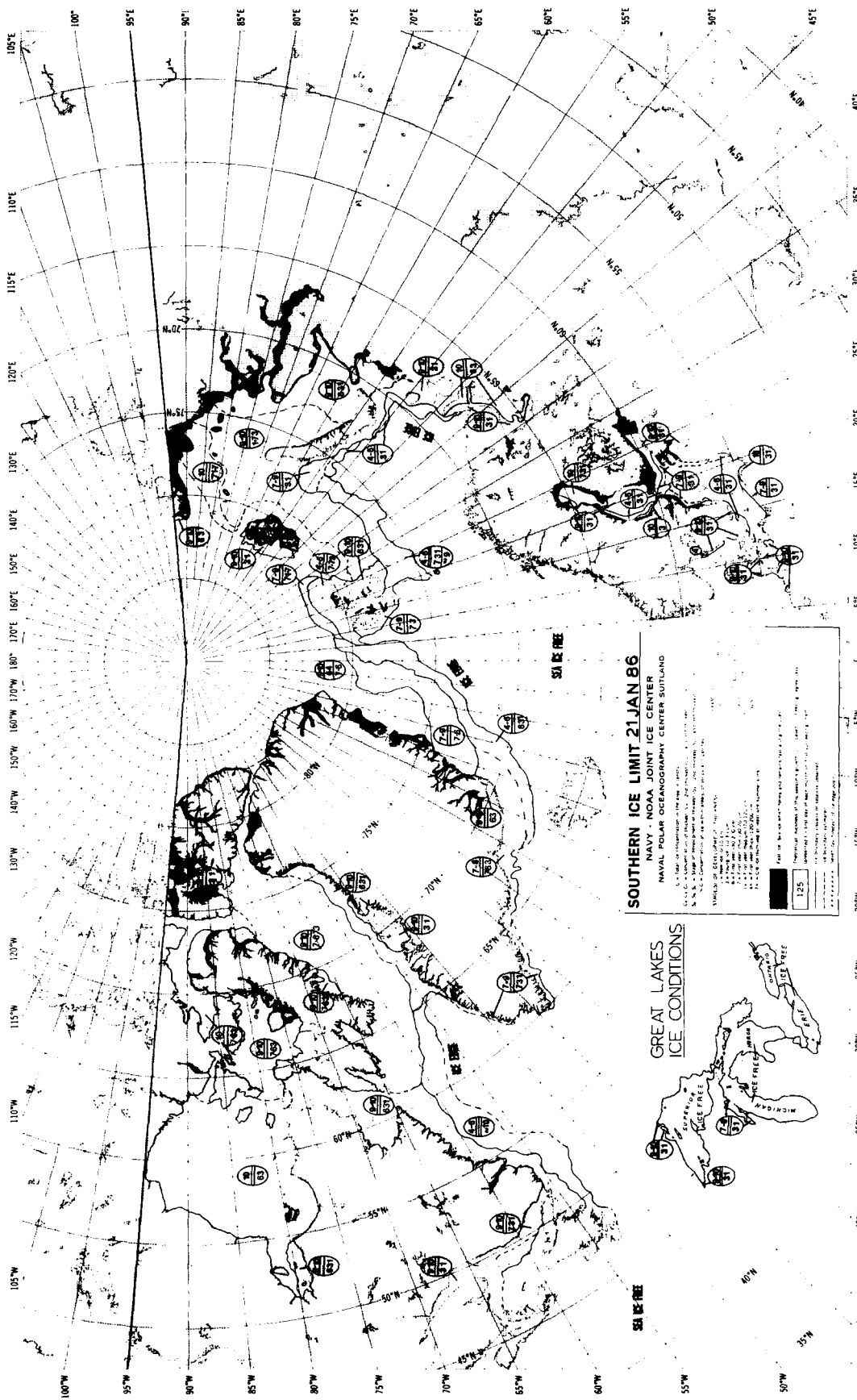
Figure 1 is a line graph showing the percentage of the total population in the labor force by age group from 1970 to 1990. The Y-axis represents the percentage of the total population in the labor force, ranging from 0 to 100. The X-axis represents the year, ranging from 1970 to 1990. The graph shows six age groups: 15-24, 25-34, 35-44, 45-54, 55-64, and 65+. The 15-24 age group shows a steady decline from approximately 25% in 1970 to 15% in 1990. The 25-34 age group shows a slight increase from approximately 15% in 1970 to 20% in 1990. The 35-44 age group shows a slight increase from approximately 10% in 1970 to 15% in 1990. The 45-54 age group shows a slight increase from approximately 5% in 1970 to 10% in 1990. The 55-64 age group shows a slight increase from approximately 2% in 1970 to 5% in 1990. The 65+ age group shows a slight increase from approximately 1% in 1970 to 2% in 1990.

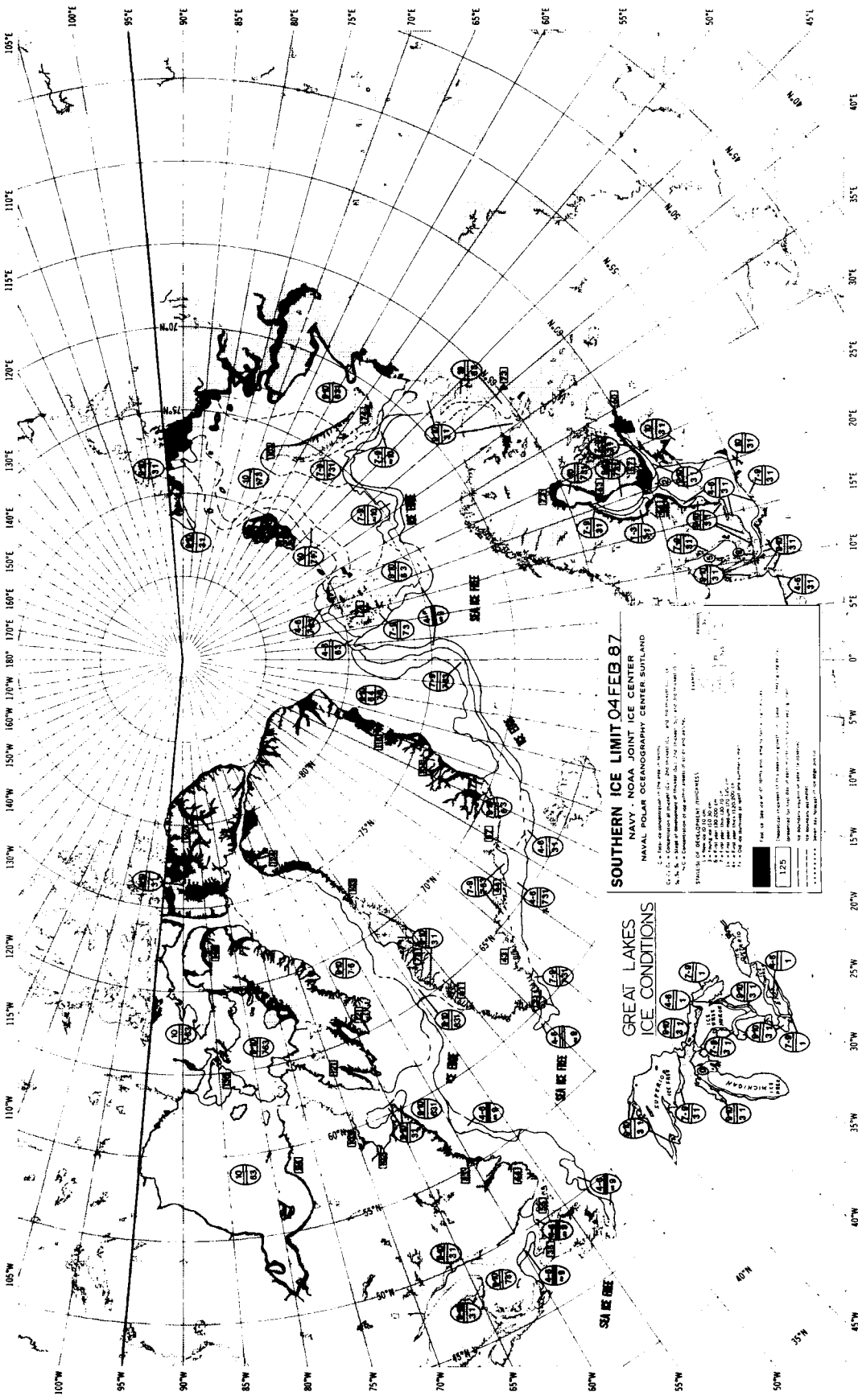
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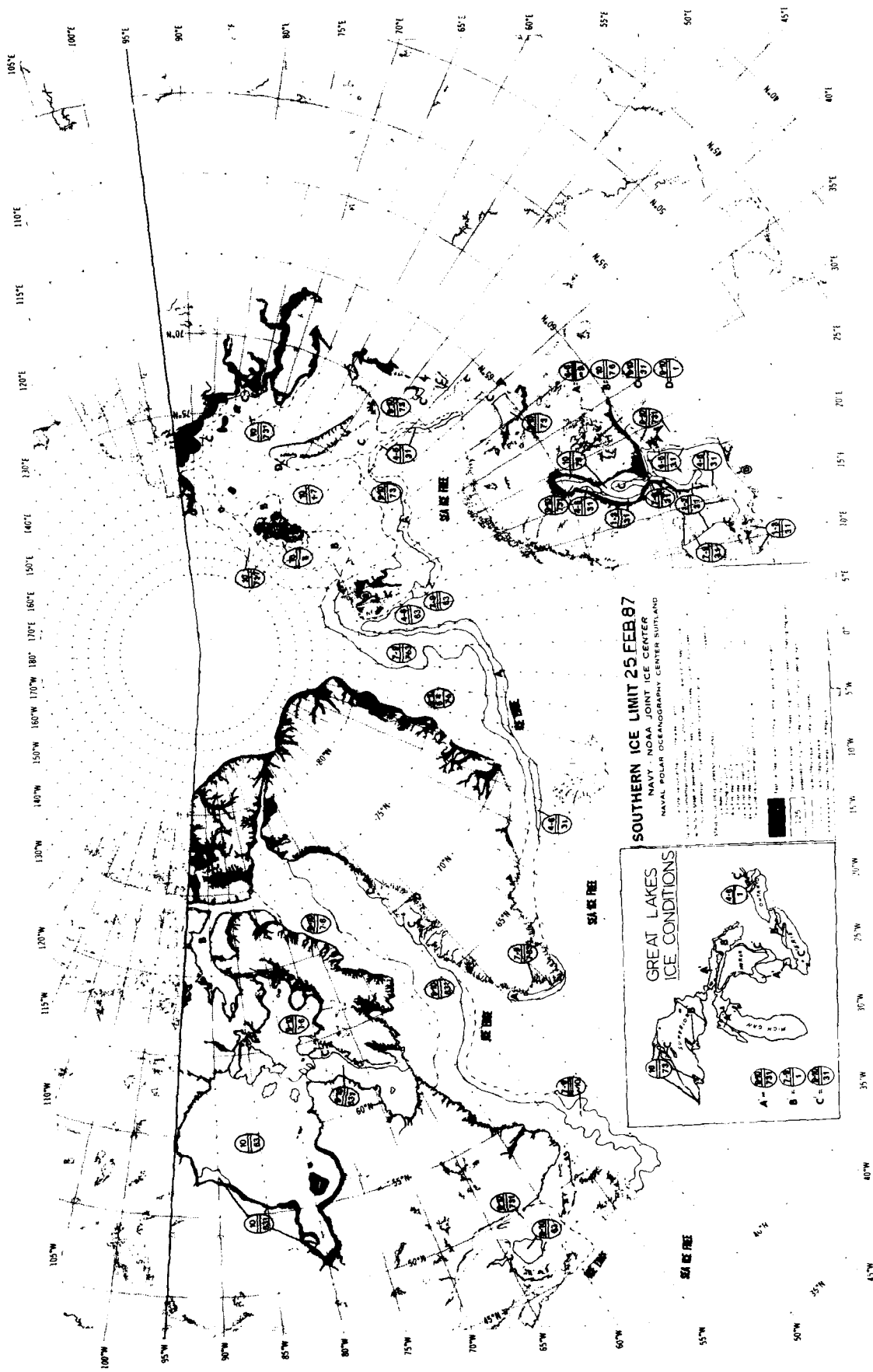
GREAT LAKES
ICE CONDITIONS

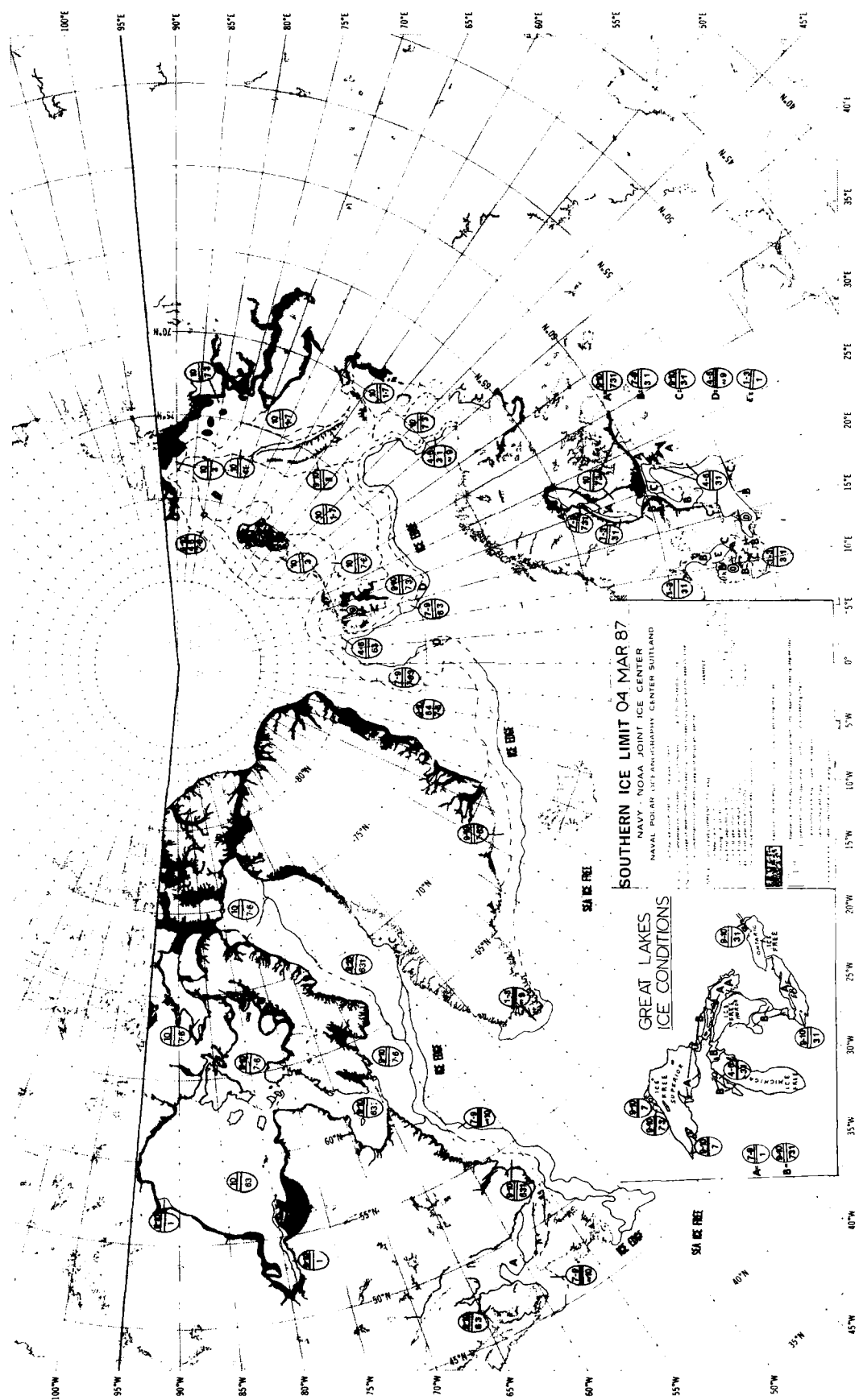








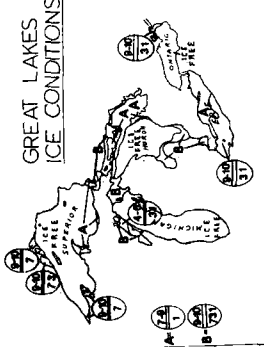


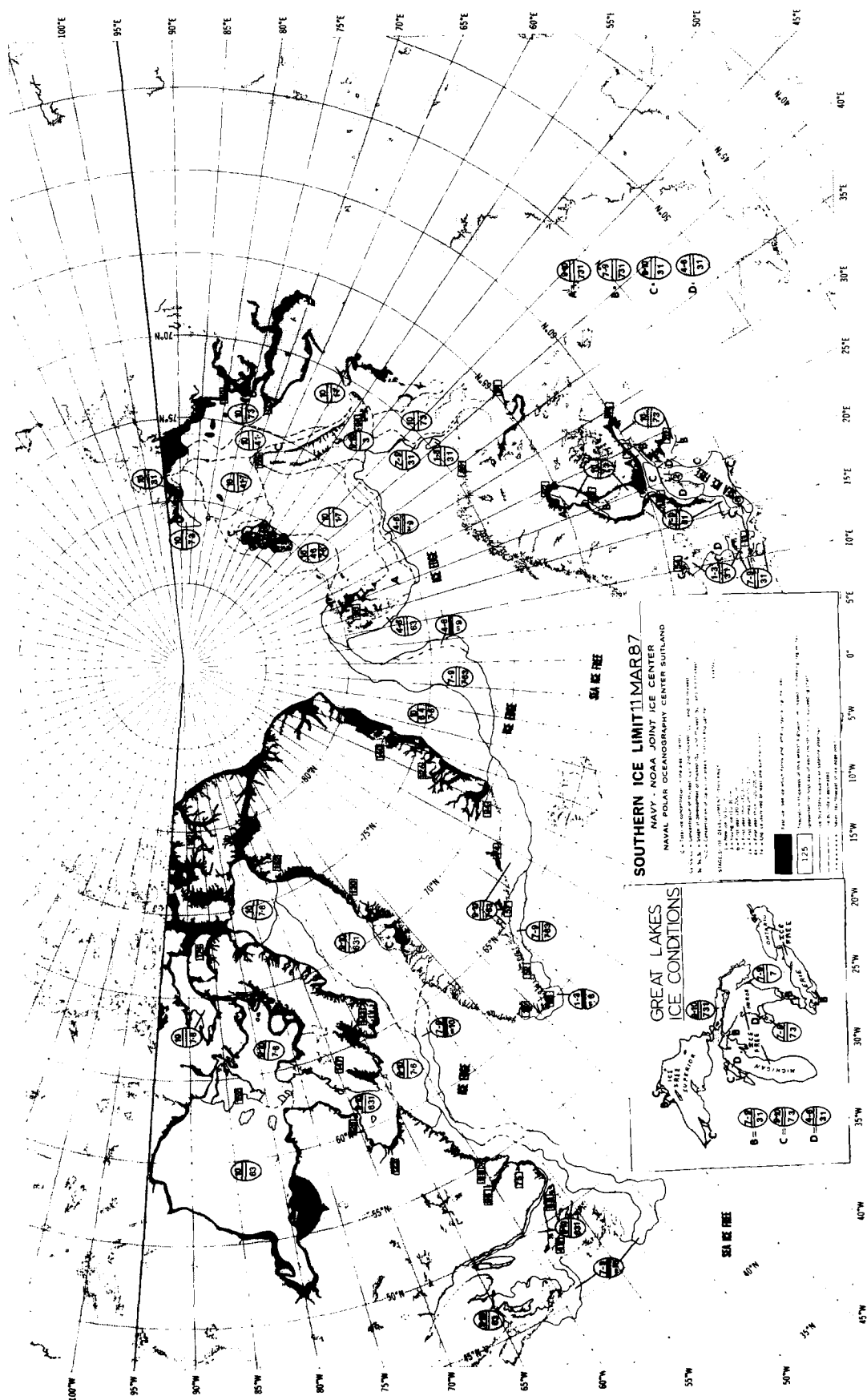


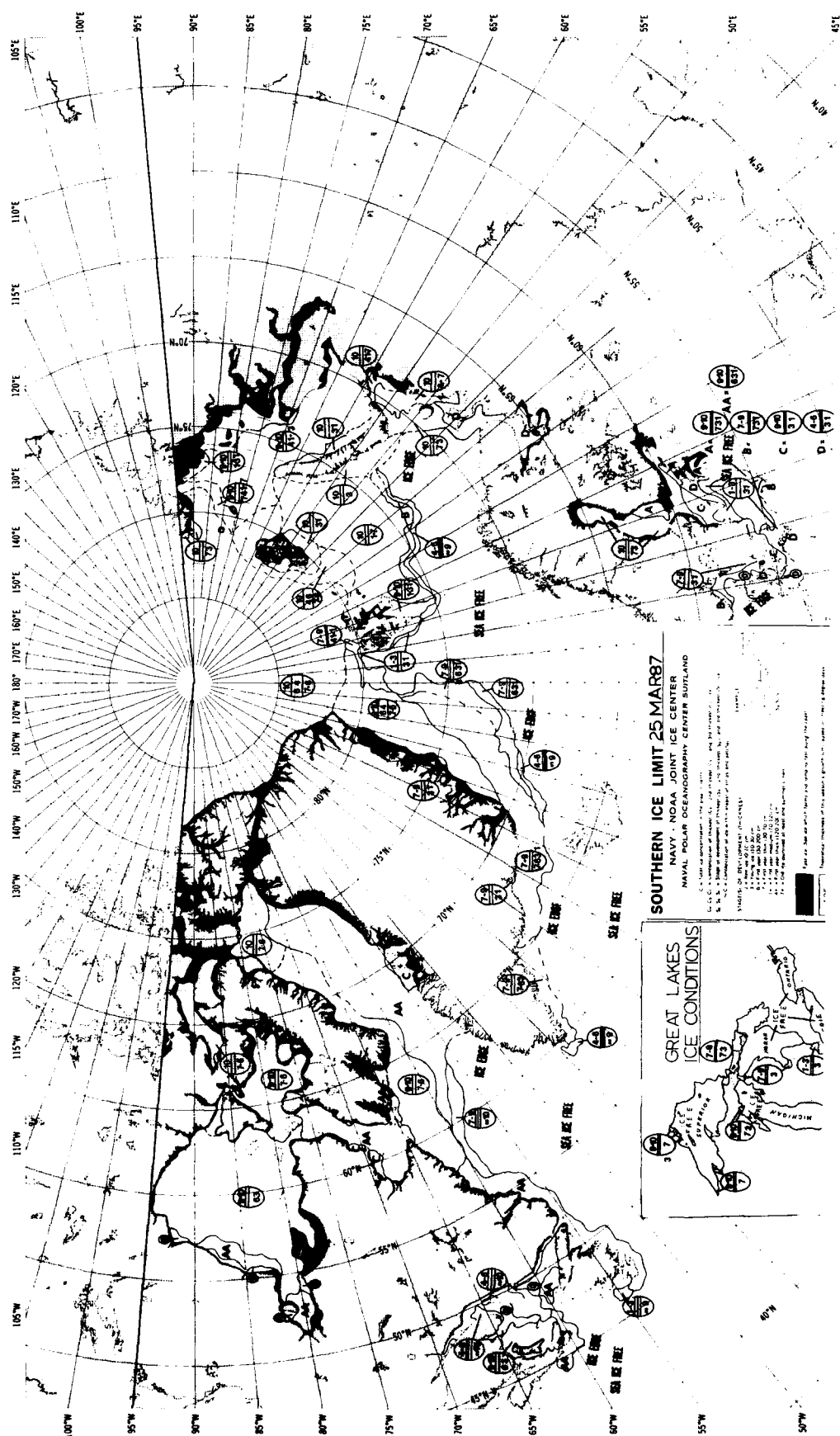
SOUTHERN ICE LIMIT 04 MAR 87

NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR INTERAGENCY CENTER SUTLAND

GREAT LAKES
ICE CONDITIONS



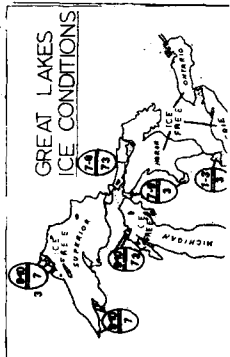


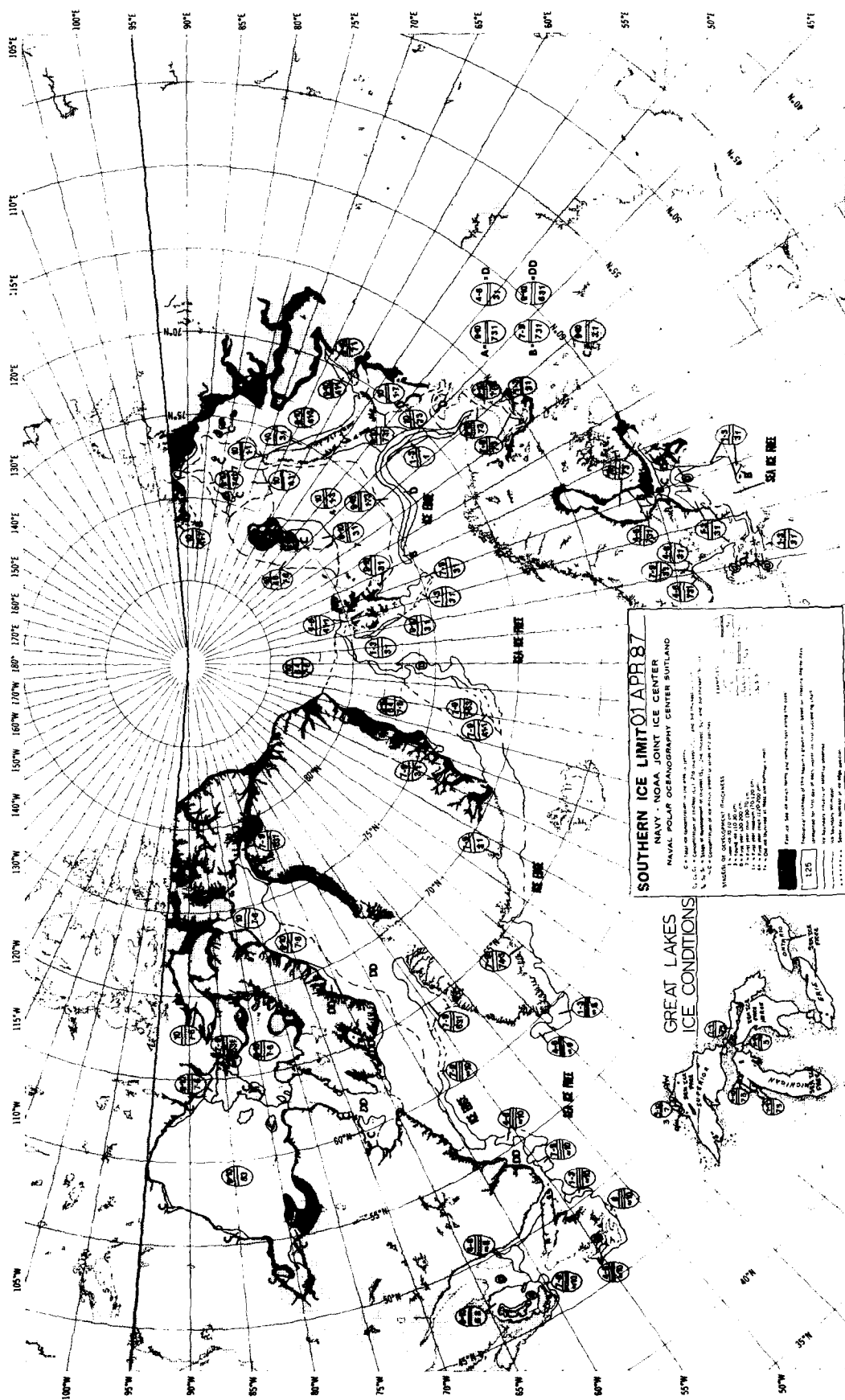


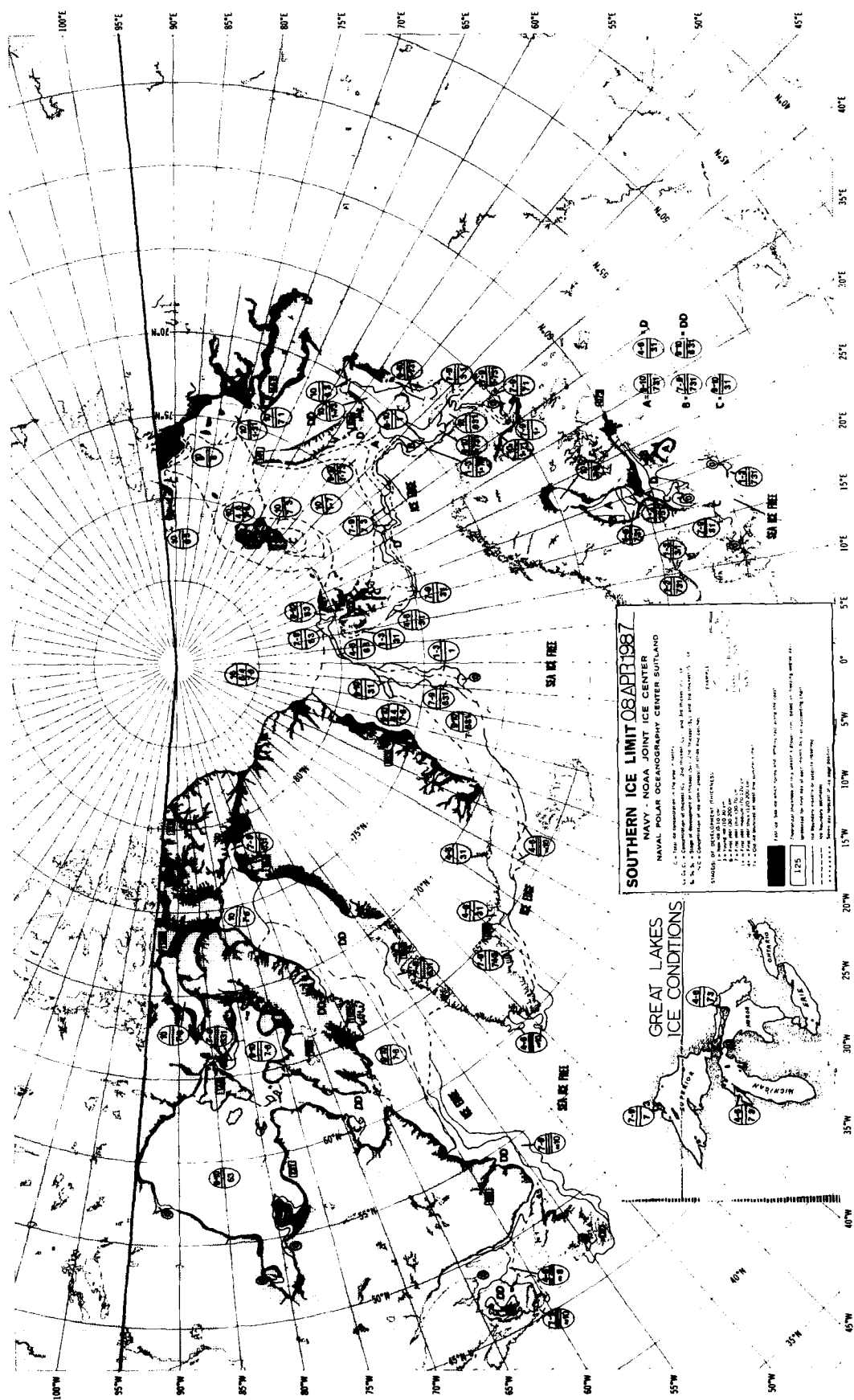
SOUTHERN ICE LIMIT 25 MAR87

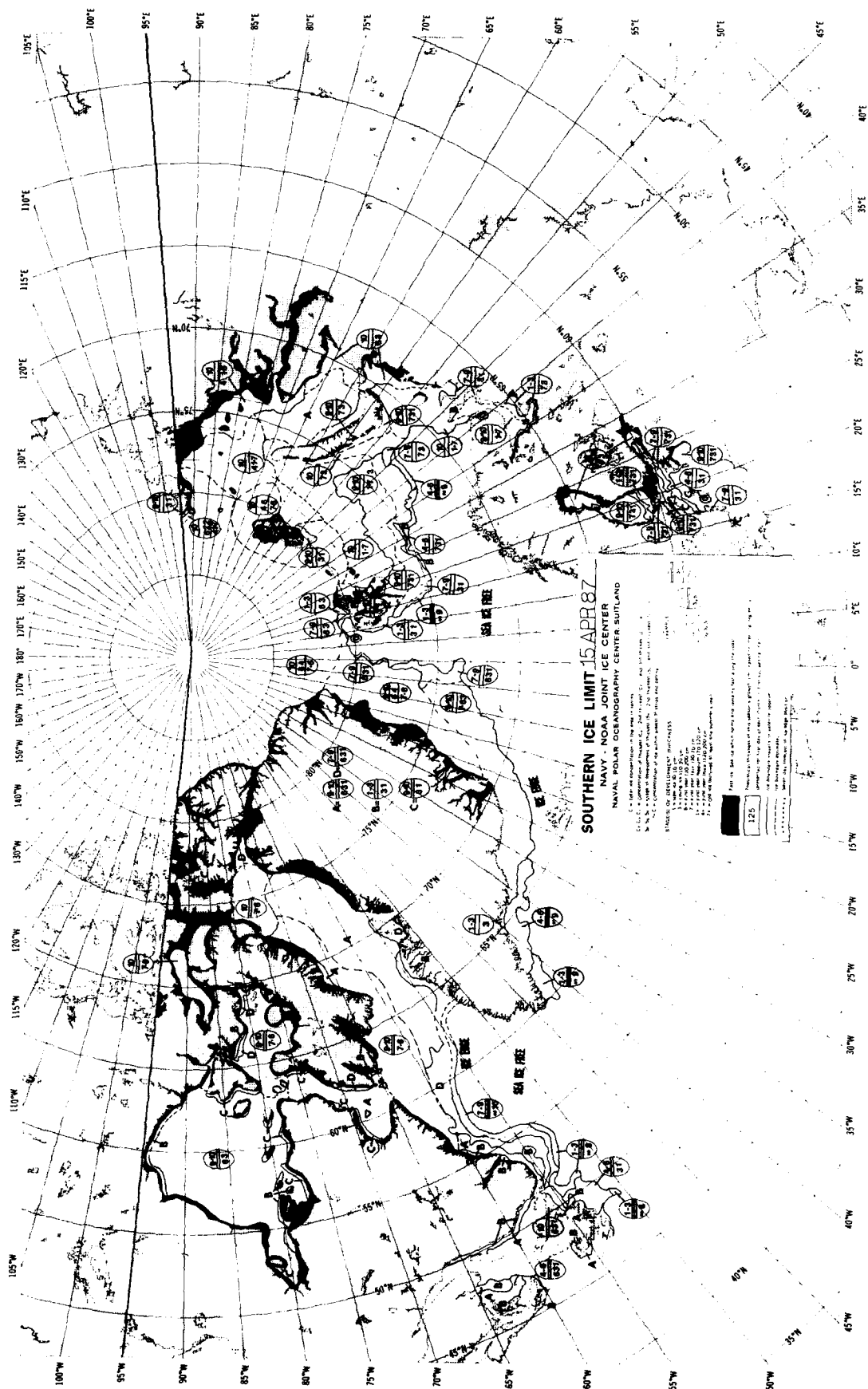
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NAVAL POLAR OCEANOGRAPHY CENTER SUTLAND

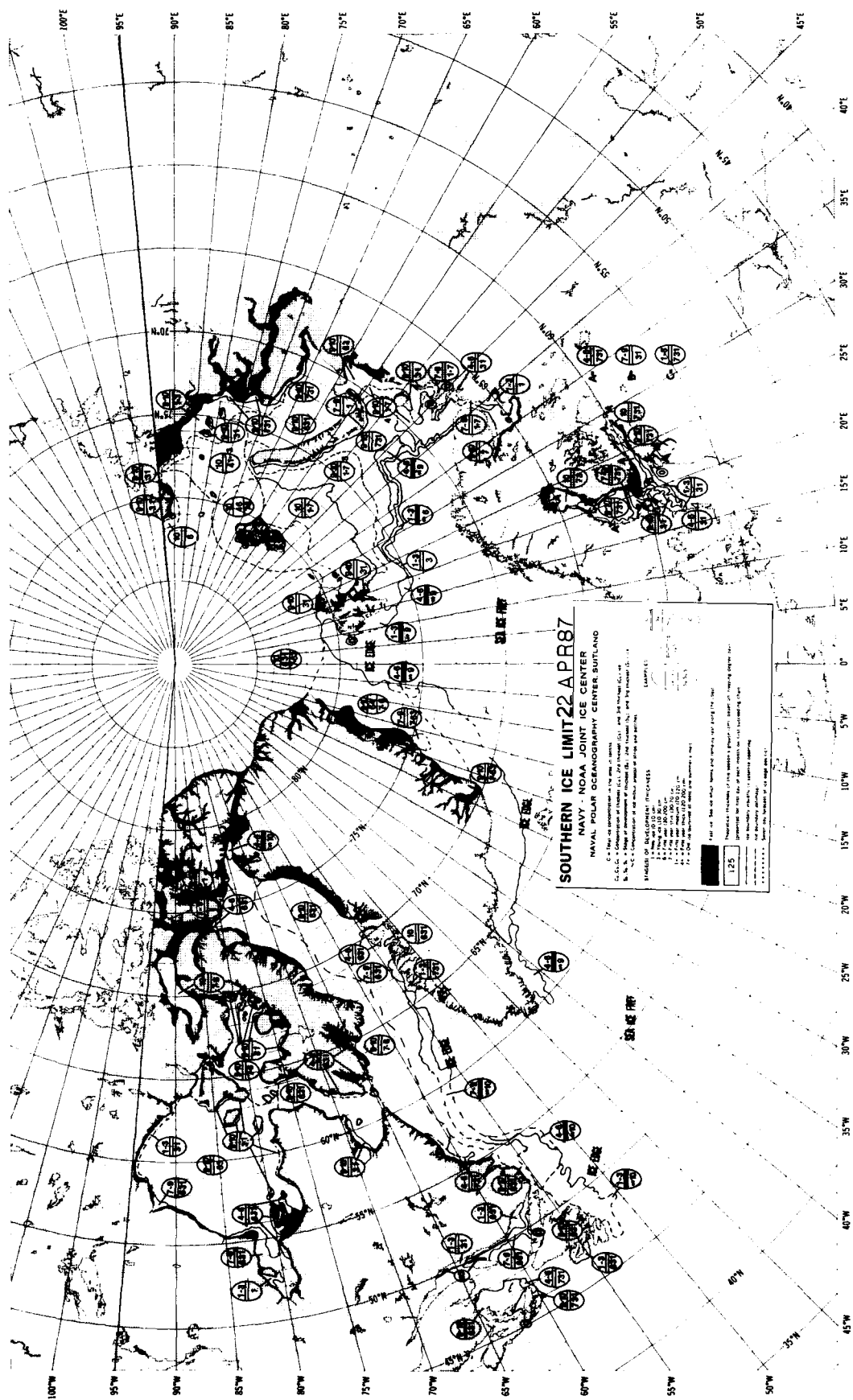
C = 100% ice concentration - 100% ice
C = 90% ice concentration - 90% ice
C = 80% ice concentration - 80% ice
C = 70% ice concentration - 70% ice
C = 60% ice concentration - 60% ice
C = 50% ice concentration - 50% ice
C = 40% ice concentration - 40% ice
C = 30% ice concentration - 30% ice
C = 20% ice concentration - 20% ice
C = 10% ice concentration - 10% ice
C = 0% ice concentration - 0% ice
C = 10% ice concentration - 10% ice
C = 20% ice concentration - 20% ice
C = 30% ice concentration - 30% ice
C = 40% ice concentration - 40% ice
C = 50% ice concentration - 50% ice
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C = 80% ice concentration - 80% ice
C = 90% ice concentration - 90% ice
C = 100% ice concentration - 100% ice

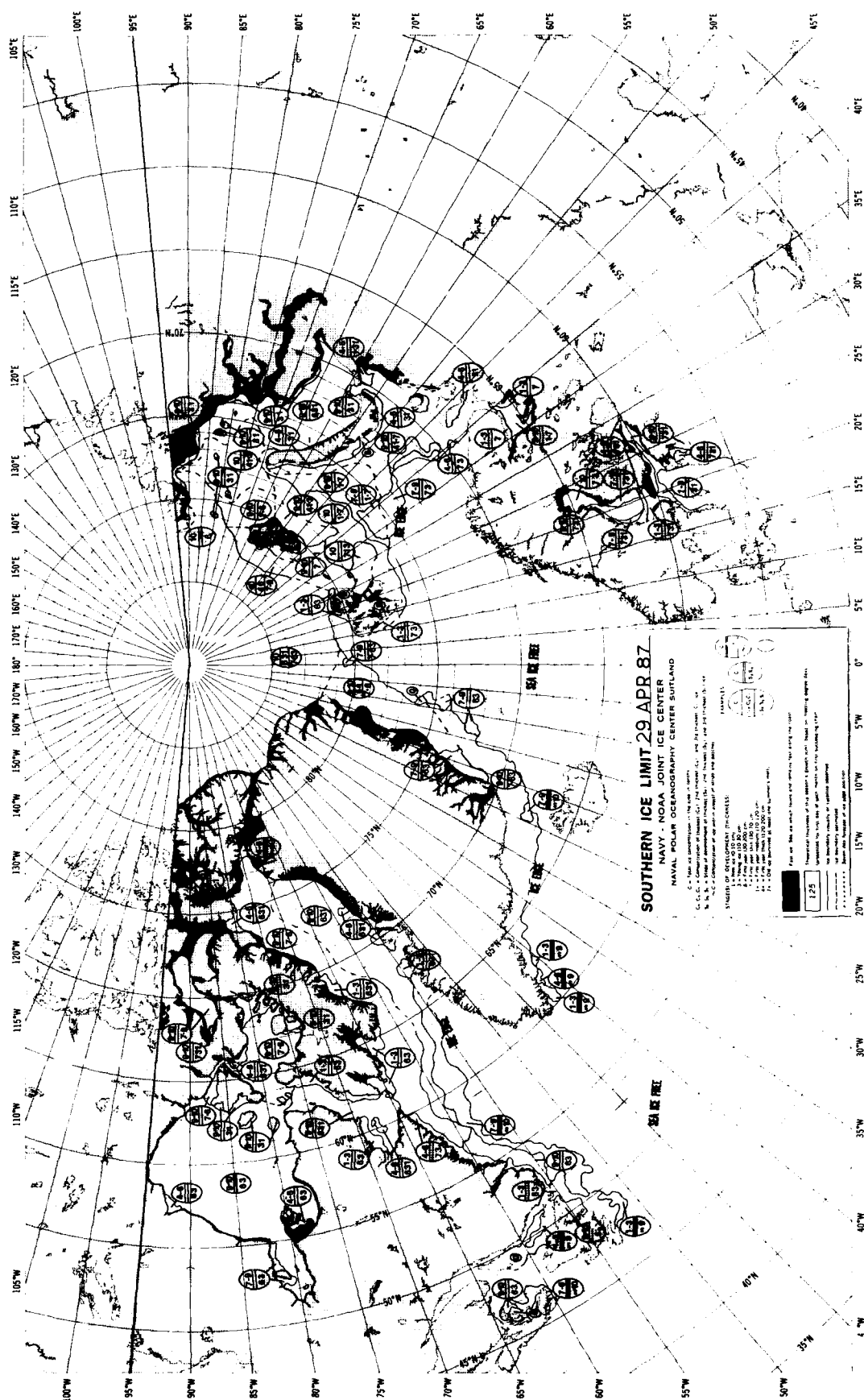


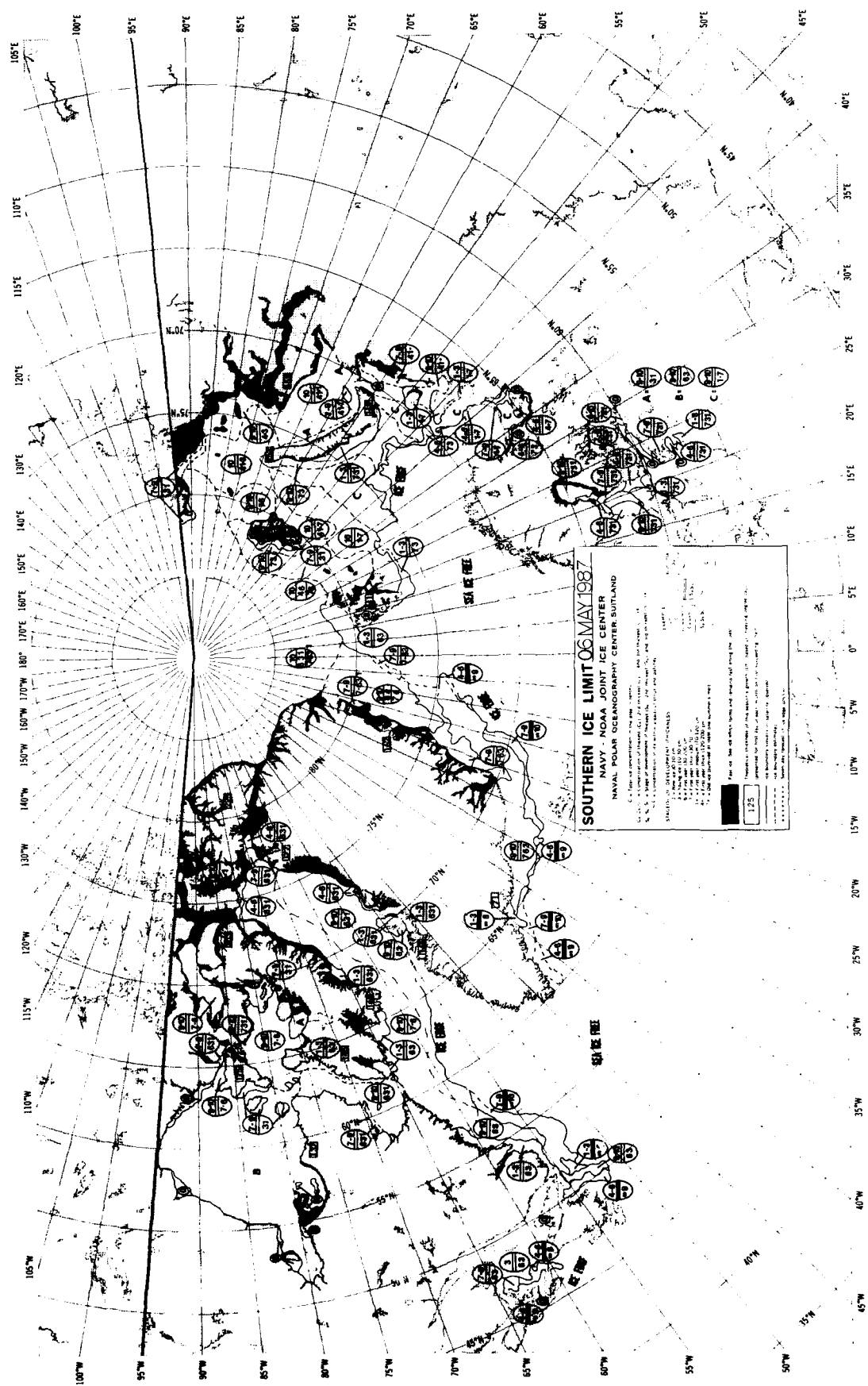


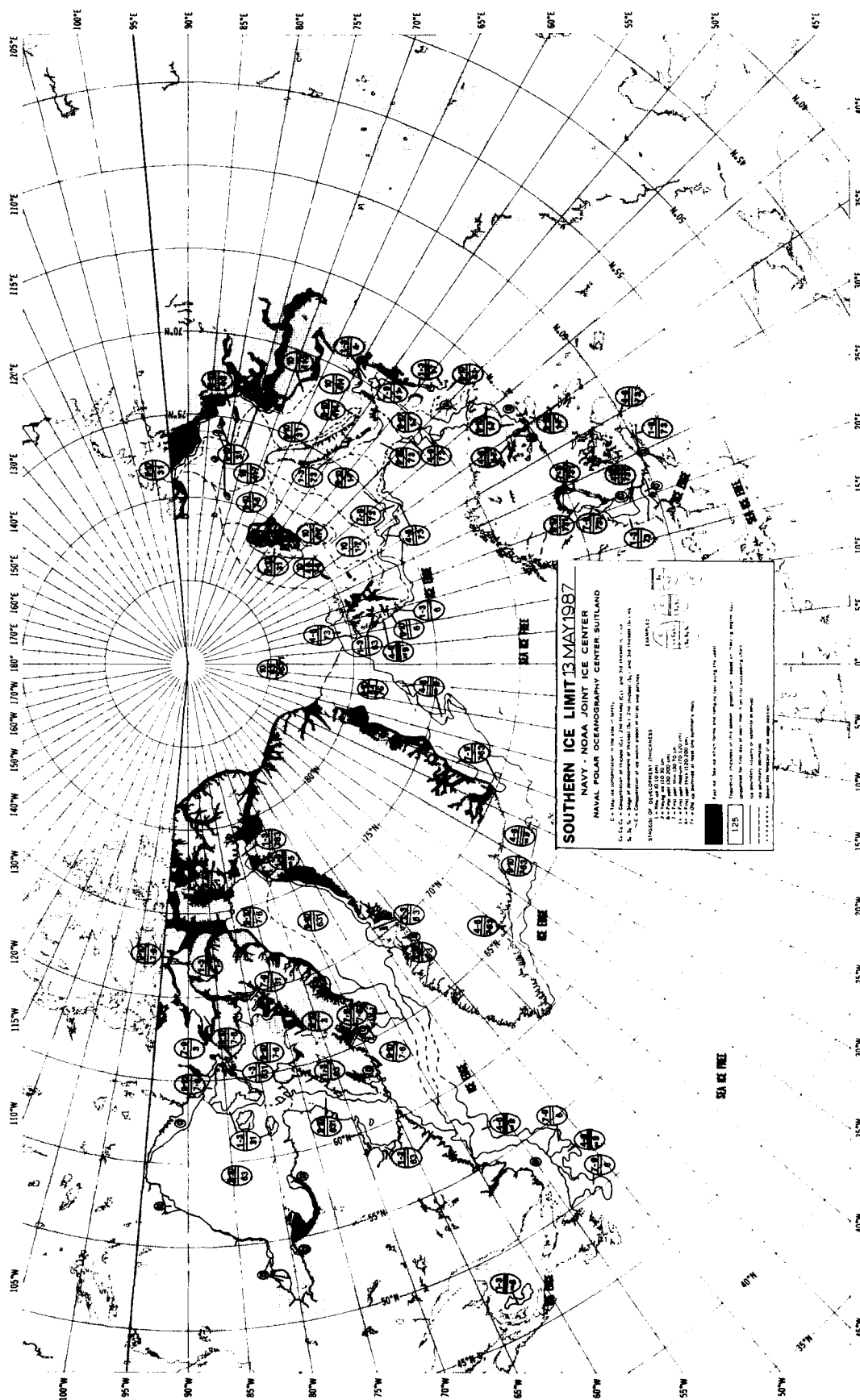


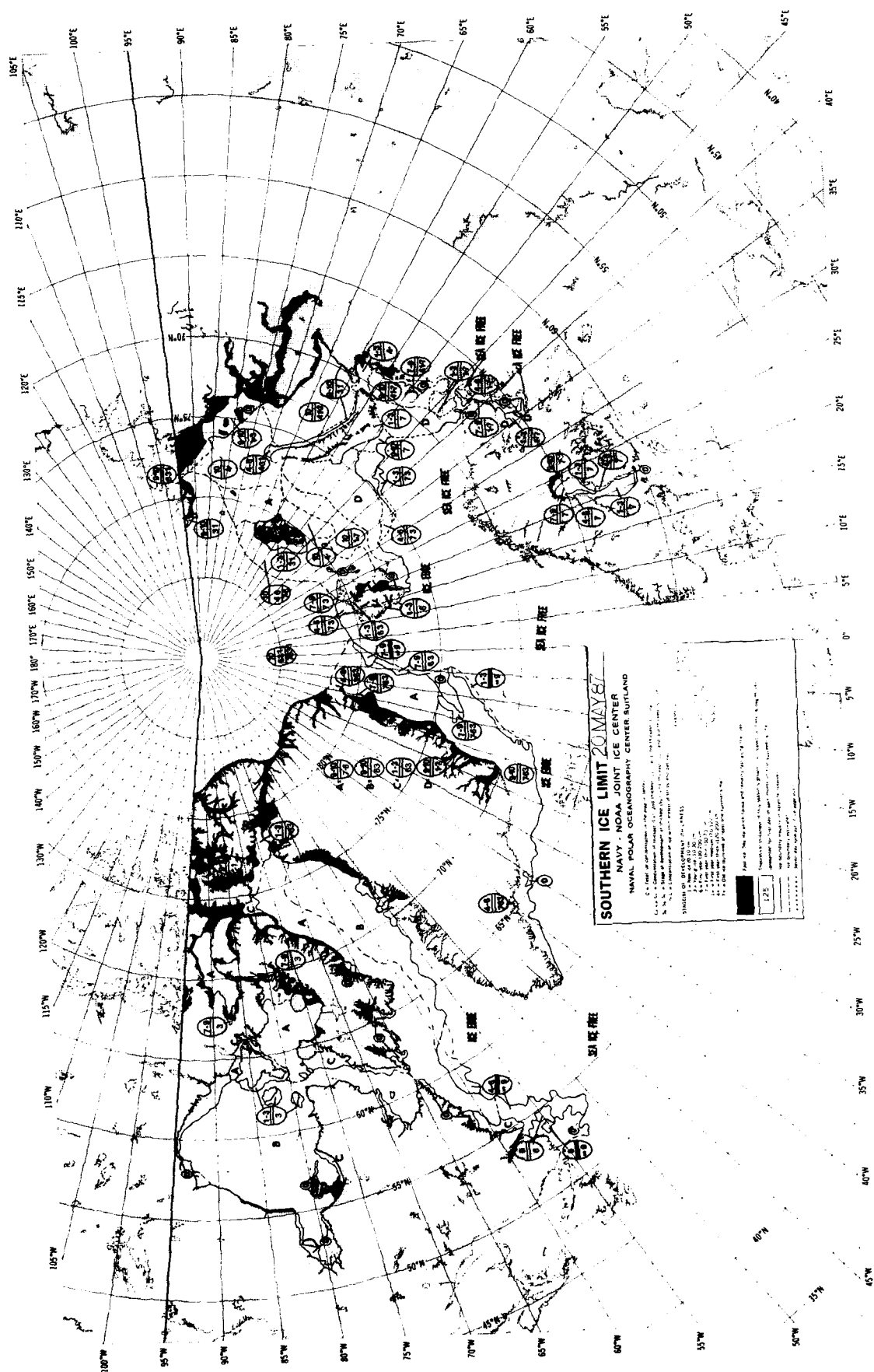


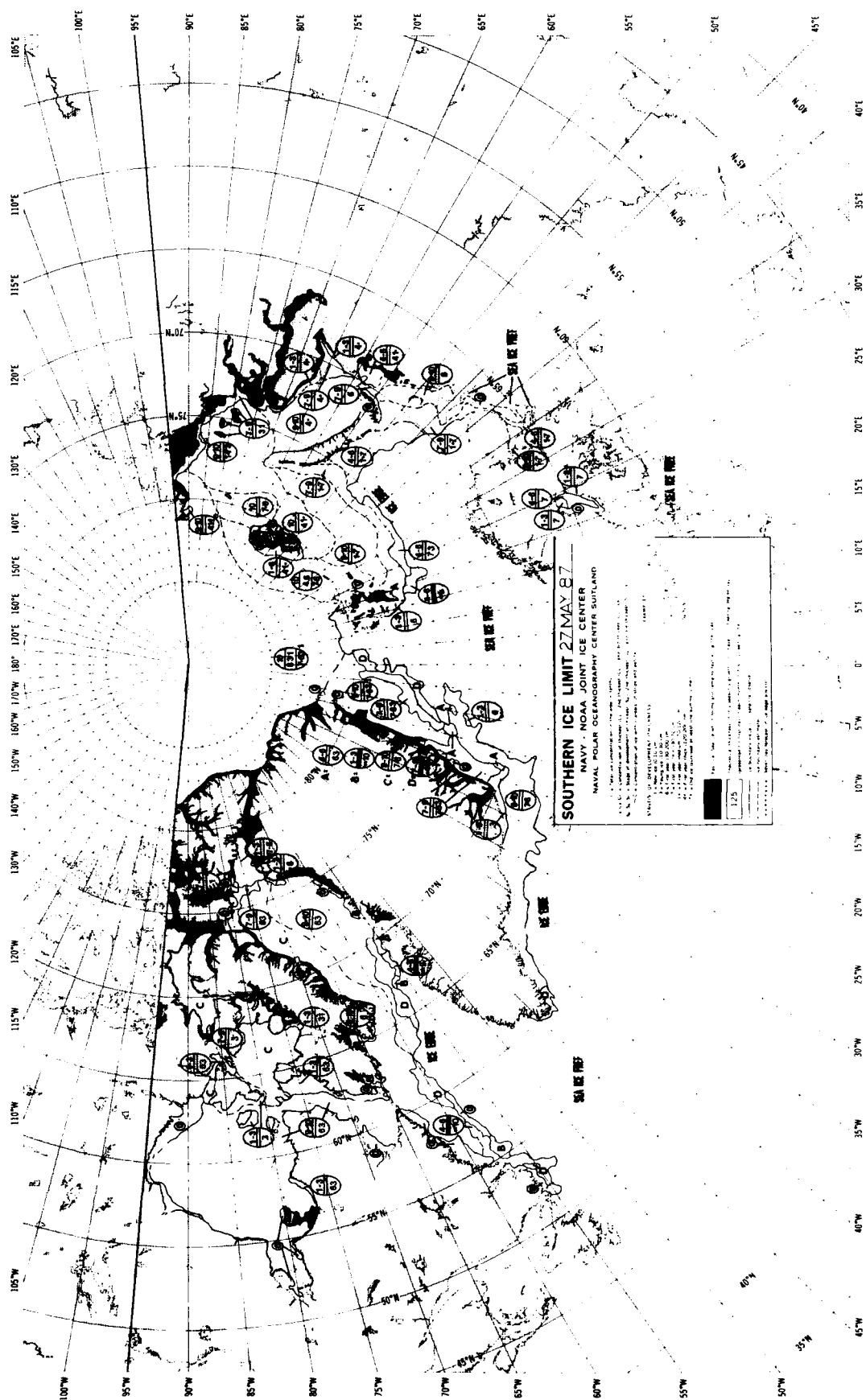




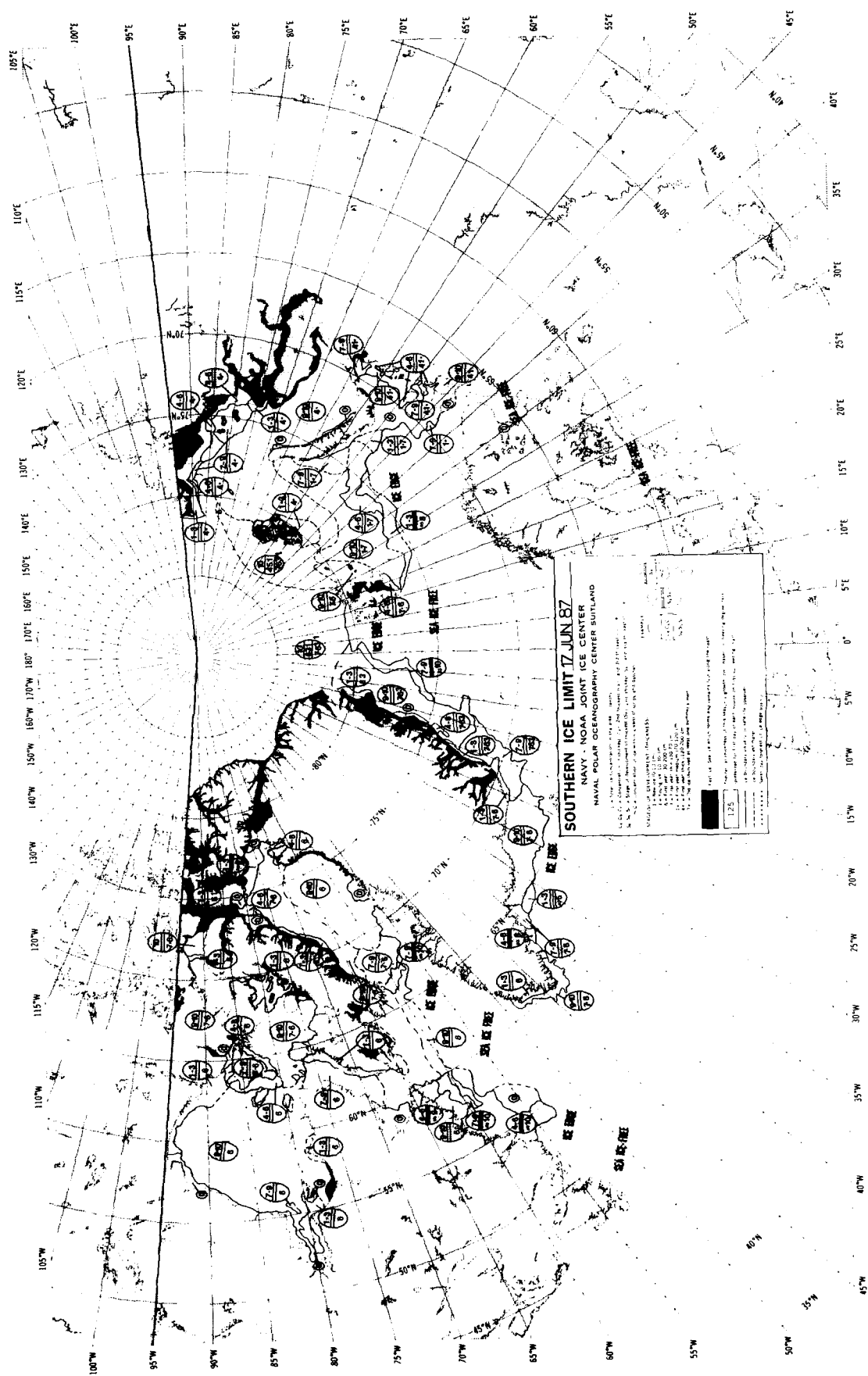


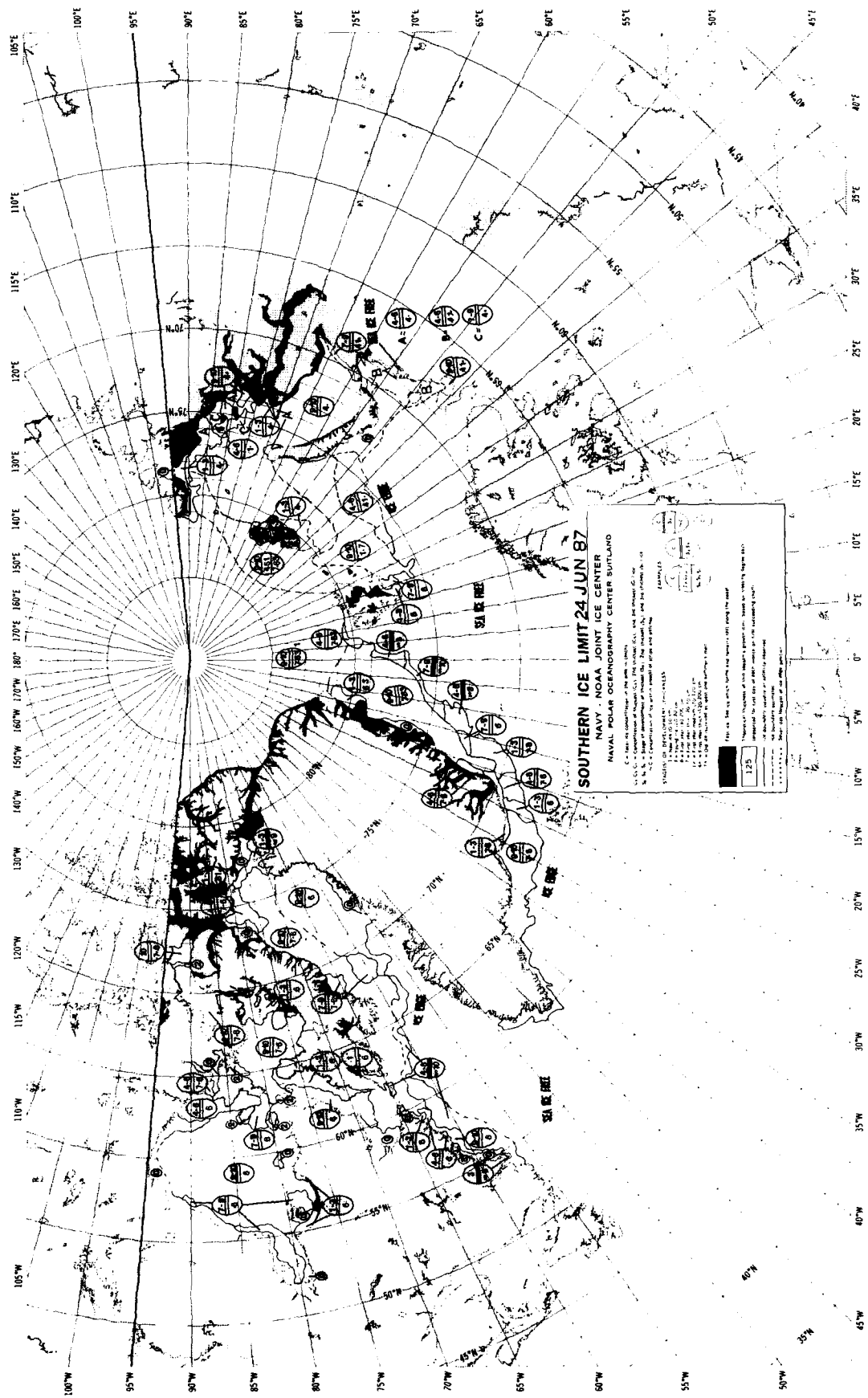












SOUTHERN ICE LIMIT 24 JUN 87

NAVY - NOAA JOINT ICE CENTER

NAVAL POLAR GEOGRAPHY CENTER BUTLAND

1. This map shows the ice limit for the month of June 1987. The ice limit is defined as the outer edge of the ice field.

2. The ice limit is shown as a solid line. The ice limit is shown as a dashed line when the ice limit is not known.

3. The ice limit is shown as a dotted line when the ice limit is not known.

4. The ice limit is shown as a dash-dot line when the ice limit is not known.

5. The ice limit is shown as a long-dash line when the ice limit is not known.

6. The ice limit is shown as a short-dash line when the ice limit is not known.

7. The ice limit is shown as a solid line when the ice limit is not known.

8. The ice limit is shown as a dashed line when the ice limit is not known.

9. The ice limit is shown as a dotted line when the ice limit is not known.

10. The ice limit is shown as a dash-dot line when the ice limit is not known.

11. The ice limit is shown as a long-dash line when the ice limit is not known.

12. The ice limit is shown as a short-dash line when the ice limit is not known.

13. The ice limit is shown as a solid line when the ice limit is not known.

14. The ice limit is shown as a dashed line when the ice limit is not known.

15. The ice limit is shown as a dotted line when the ice limit is not known.

16. The ice limit is shown as a dash-dot line when the ice limit is not known.

17. The ice limit is shown as a long-dash line when the ice limit is not known.

18. The ice limit is shown as a short-dash line when the ice limit is not known.

19. The ice limit is shown as a solid line when the ice limit is not known.

20. The ice limit is shown as a dashed line when the ice limit is not known.

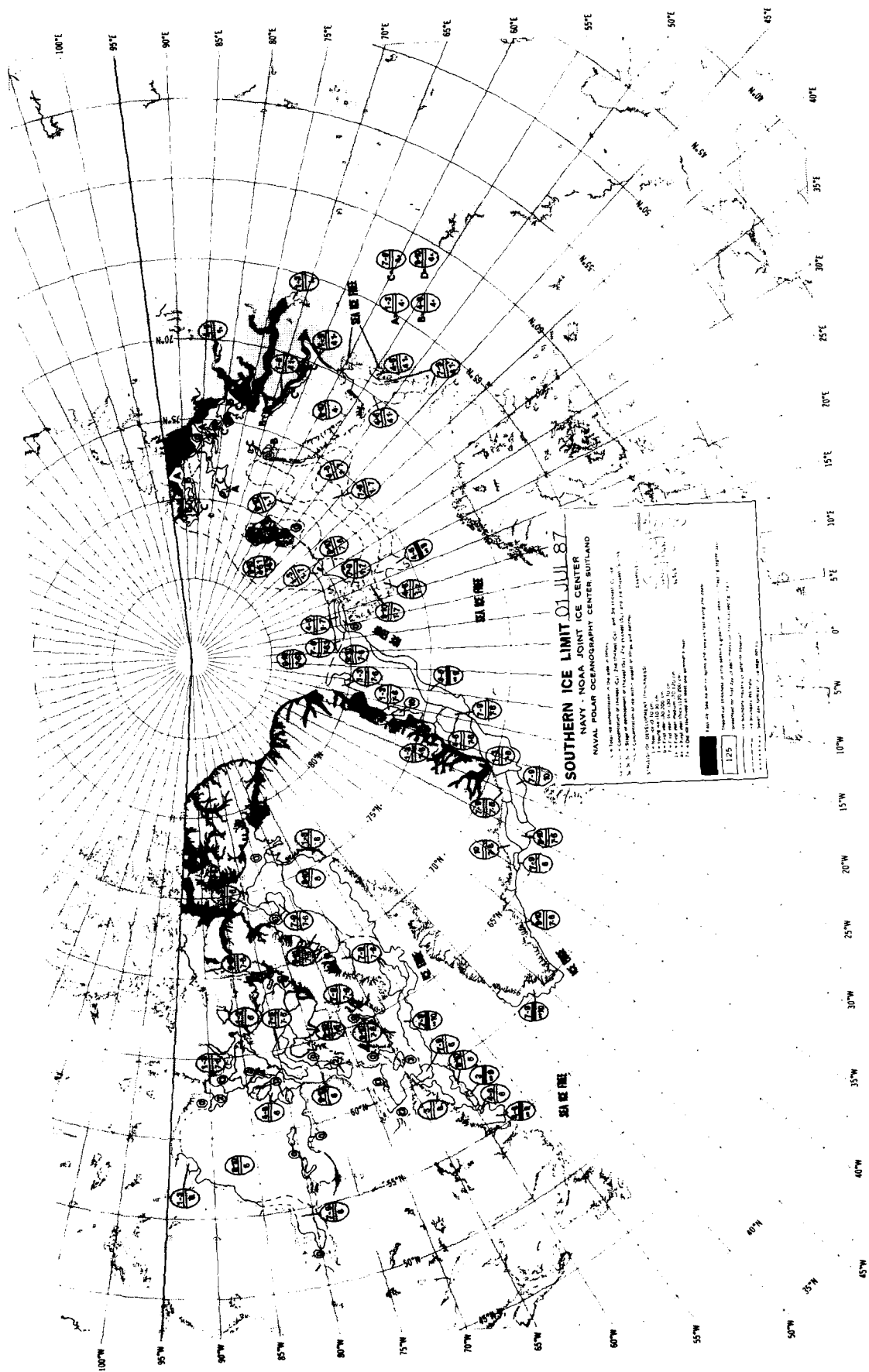
21. The ice limit is shown as a dotted line when the ice limit is not known.

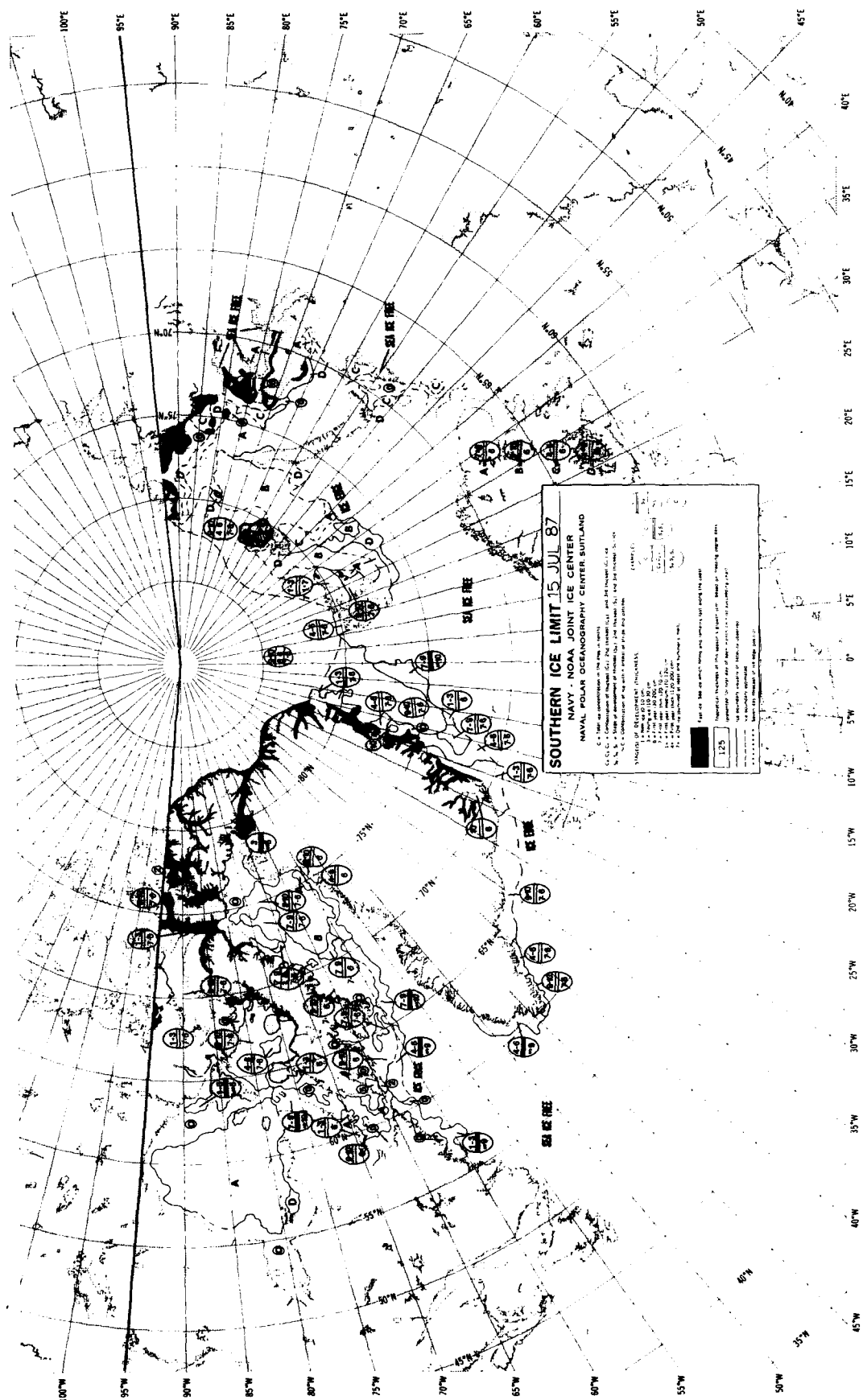
22. The ice limit is shown as a dash-dot line when the ice limit is not known.

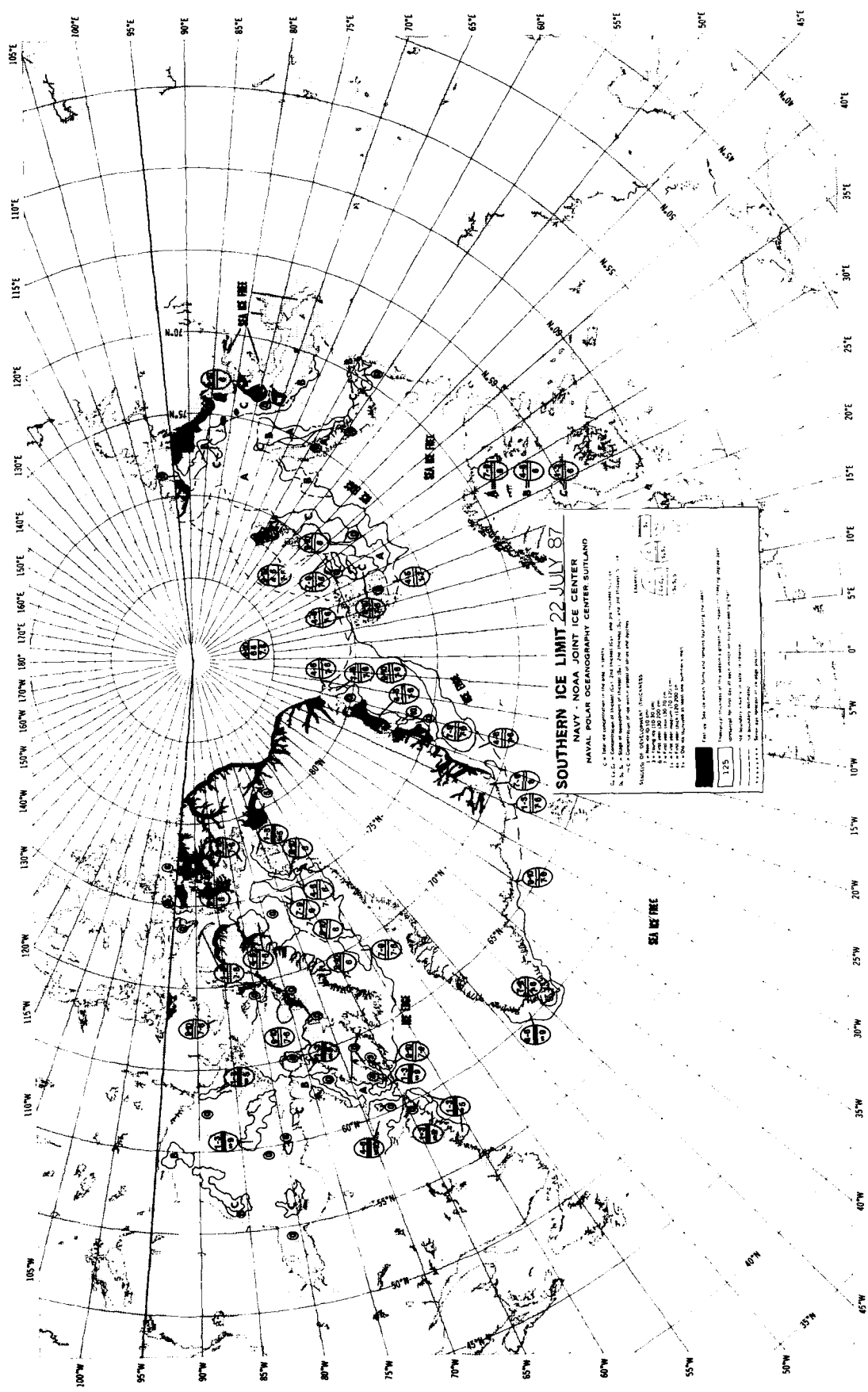
23. The ice limit is shown as a long-dash line when the ice limit is not known.

24. The ice limit is shown as a short-dash line when the ice limit is not known.

25. The ice limit is shown as a solid line when the ice limit is not known.







SOUTHERN ICE LIMIT 22 JULY 87

NAVY - NOAA JOINT ICE CENTER

NAVAL POLAR OCEANOGRAPHY CENTER SUTLAND

1. This map is a representation of the ice limit as of 22 July 1987. It is not a forecast of the ice limit for any other date.

2. The ice limit is defined as the outer edge of the ice field. It is not the edge of the ice shelf.

3. The ice limit is based on satellite data and is not a direct observation.

4. The ice limit is shown in black on this map.

5. The ice limit is shown in white on the map.

6. The ice limit is shown in gray on the map.

7. The ice limit is shown in blue on the map.

8. The ice limit is shown in green on the map.

9. The ice limit is shown in yellow on the map.

10. The ice limit is shown in orange on the map.

11. The ice limit is shown in red on the map.

12. The ice limit is shown in purple on the map.

13. The ice limit is shown in brown on the map.

14. The ice limit is shown in pink on the map.

15. The ice limit is shown in light blue on the map.

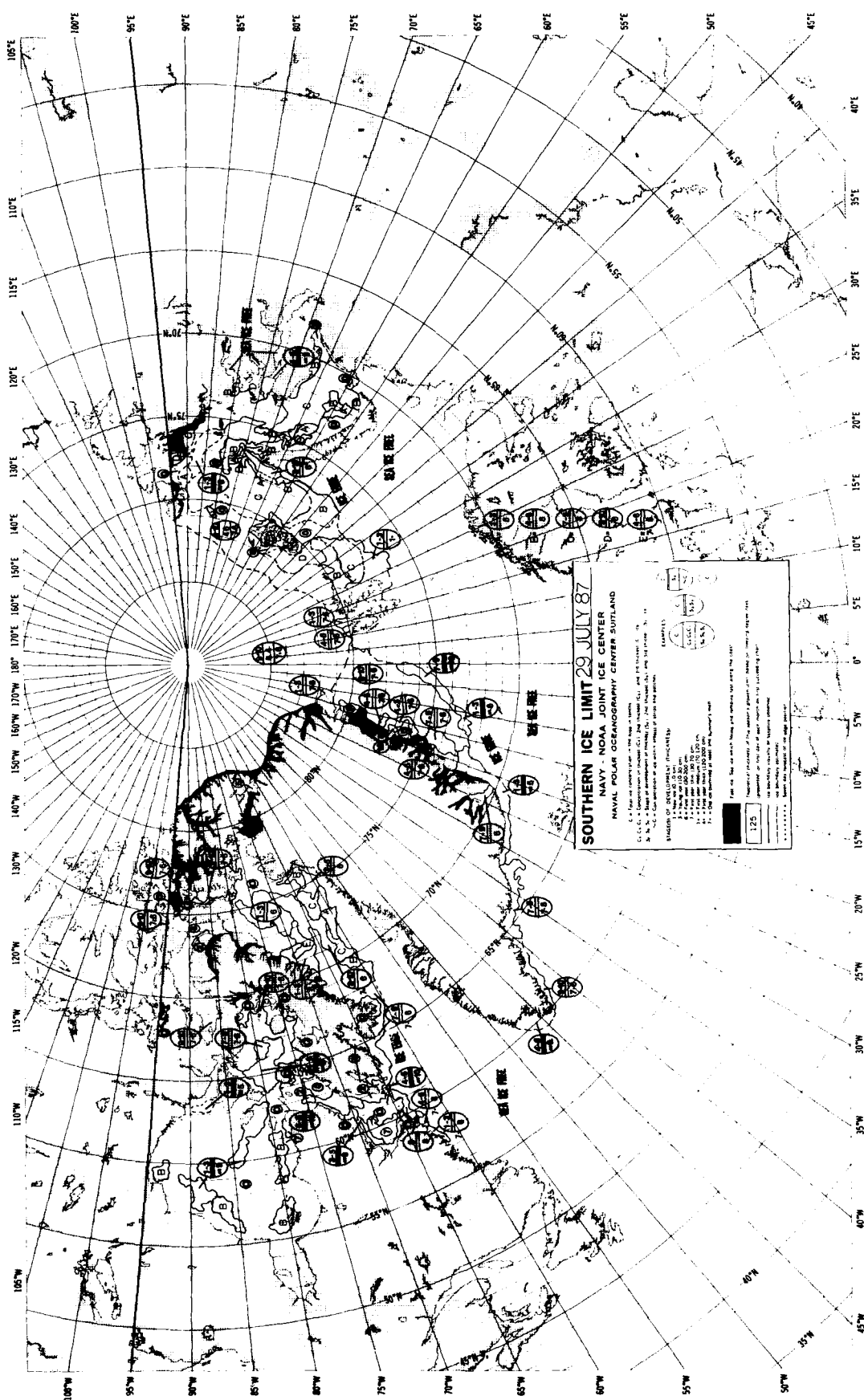
16. The ice limit is shown in light green on the map.

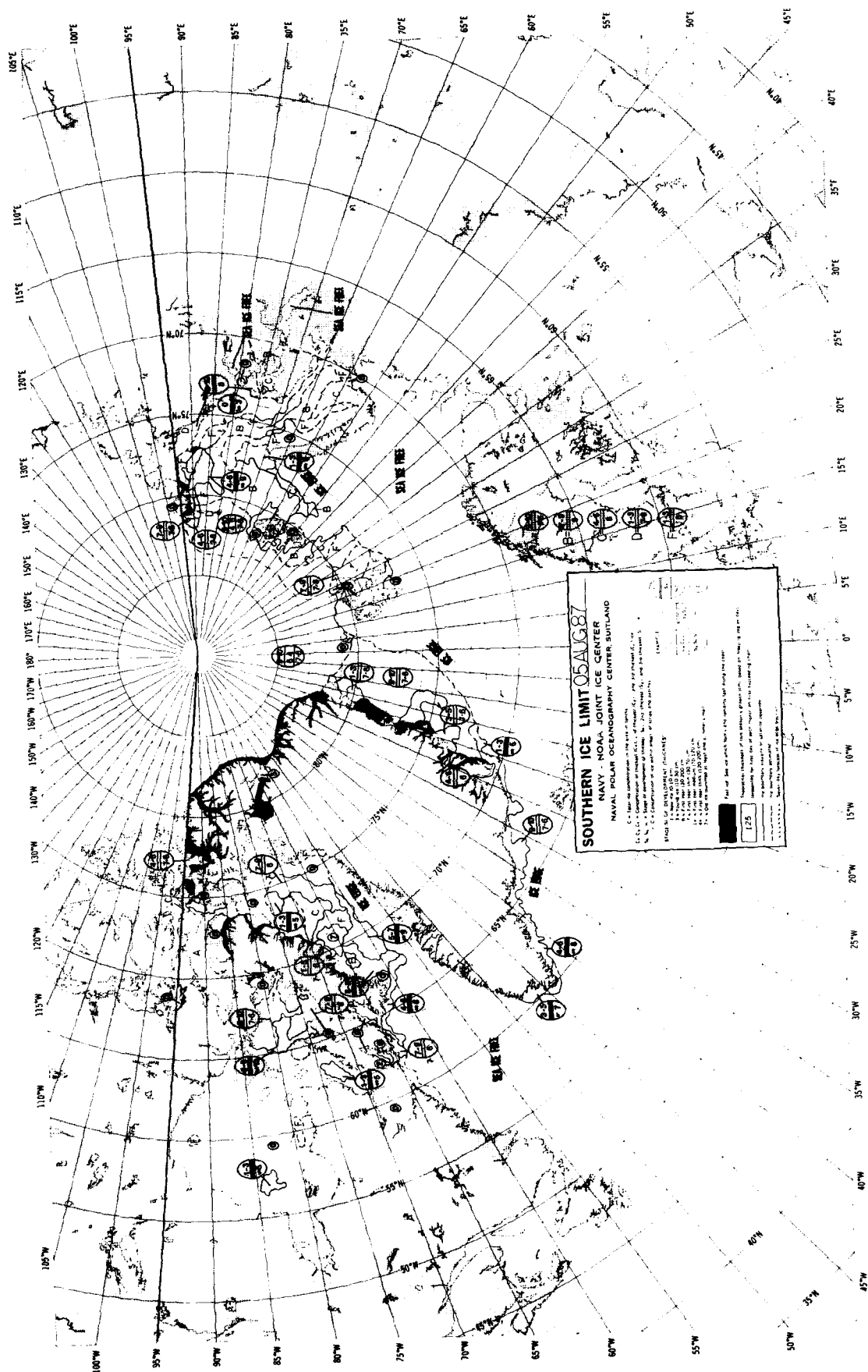
17. The ice limit is shown in light yellow on the map.

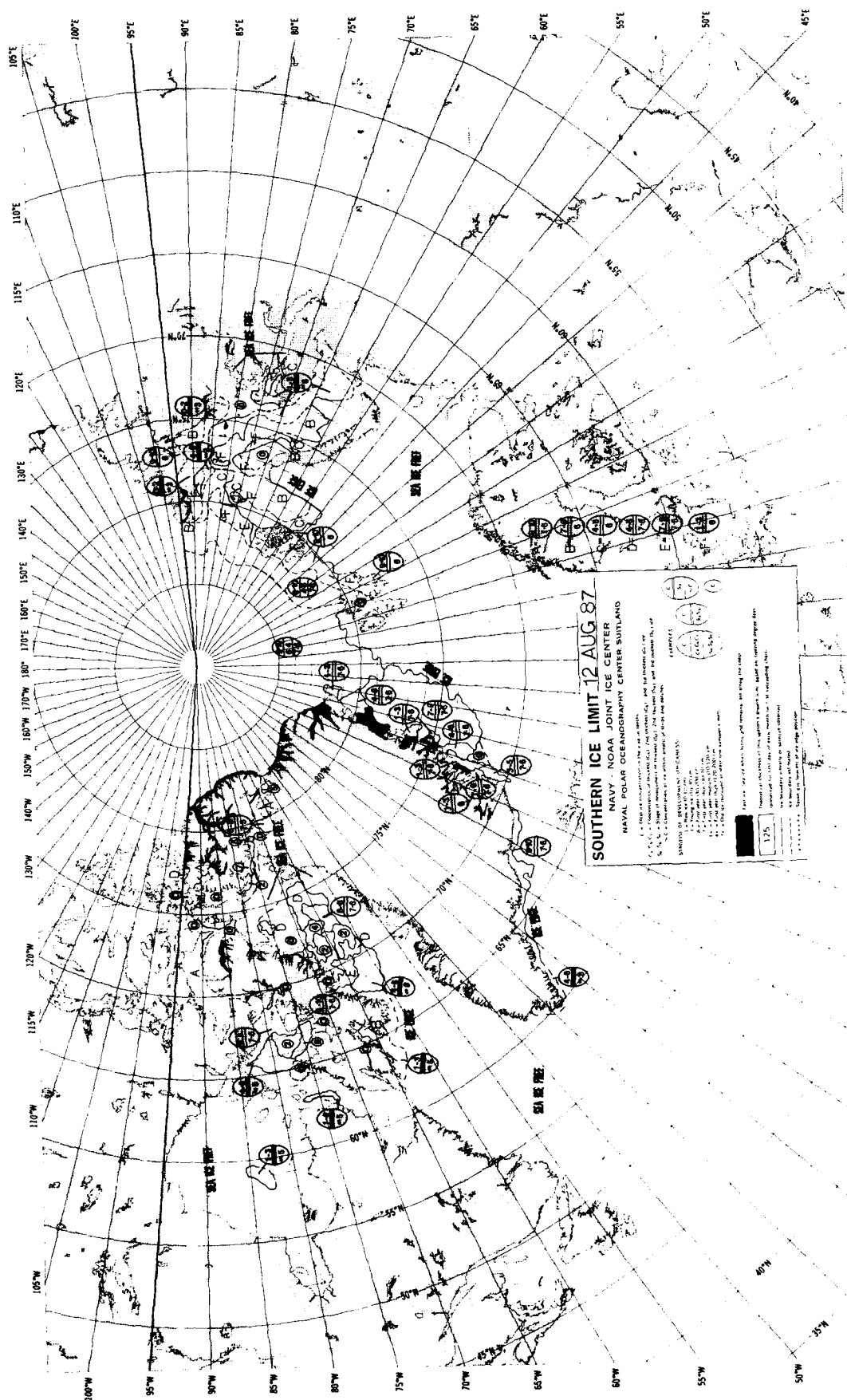
18. The ice limit is shown in light orange on the map.

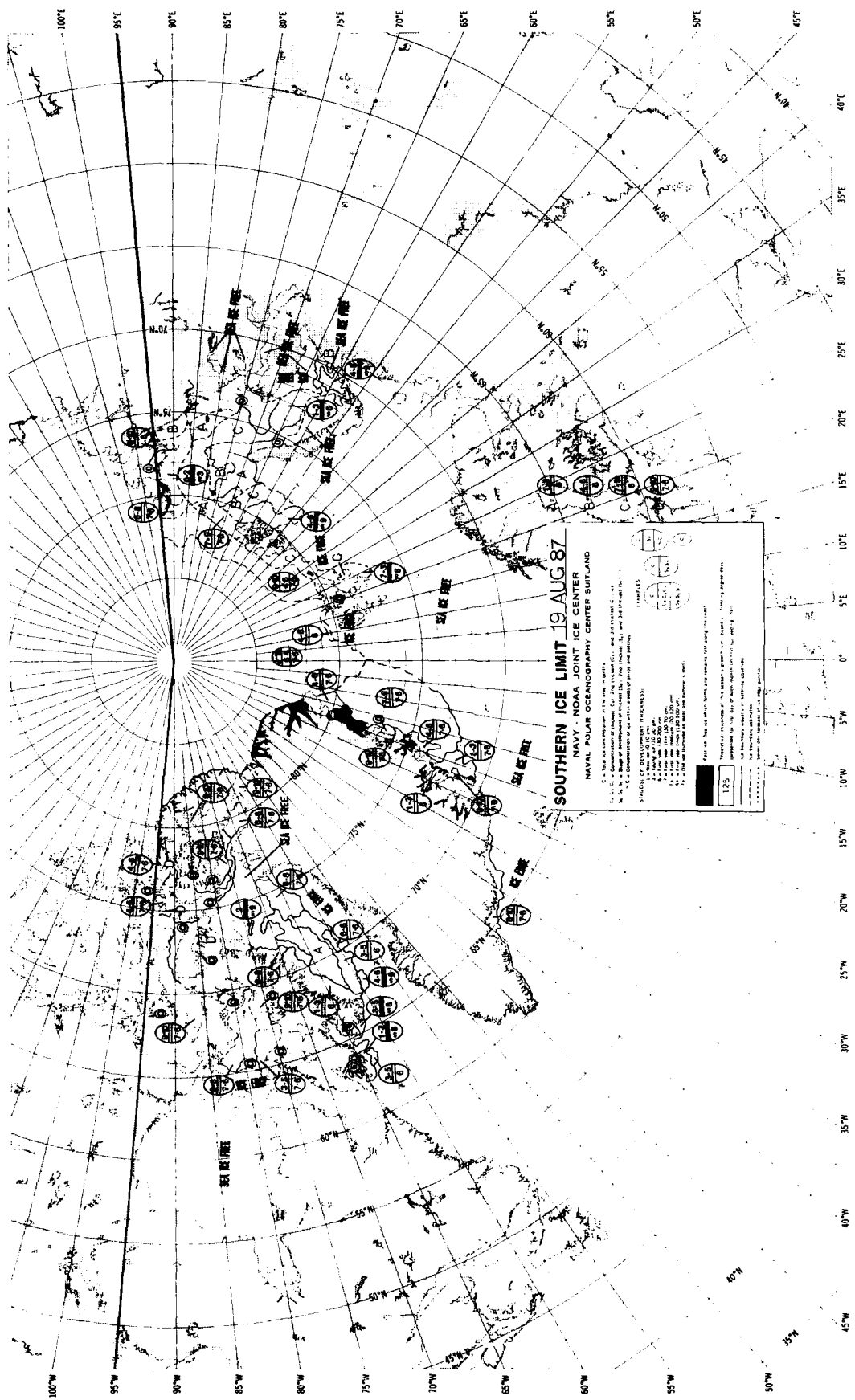
19. The ice limit is shown in light red on the map.

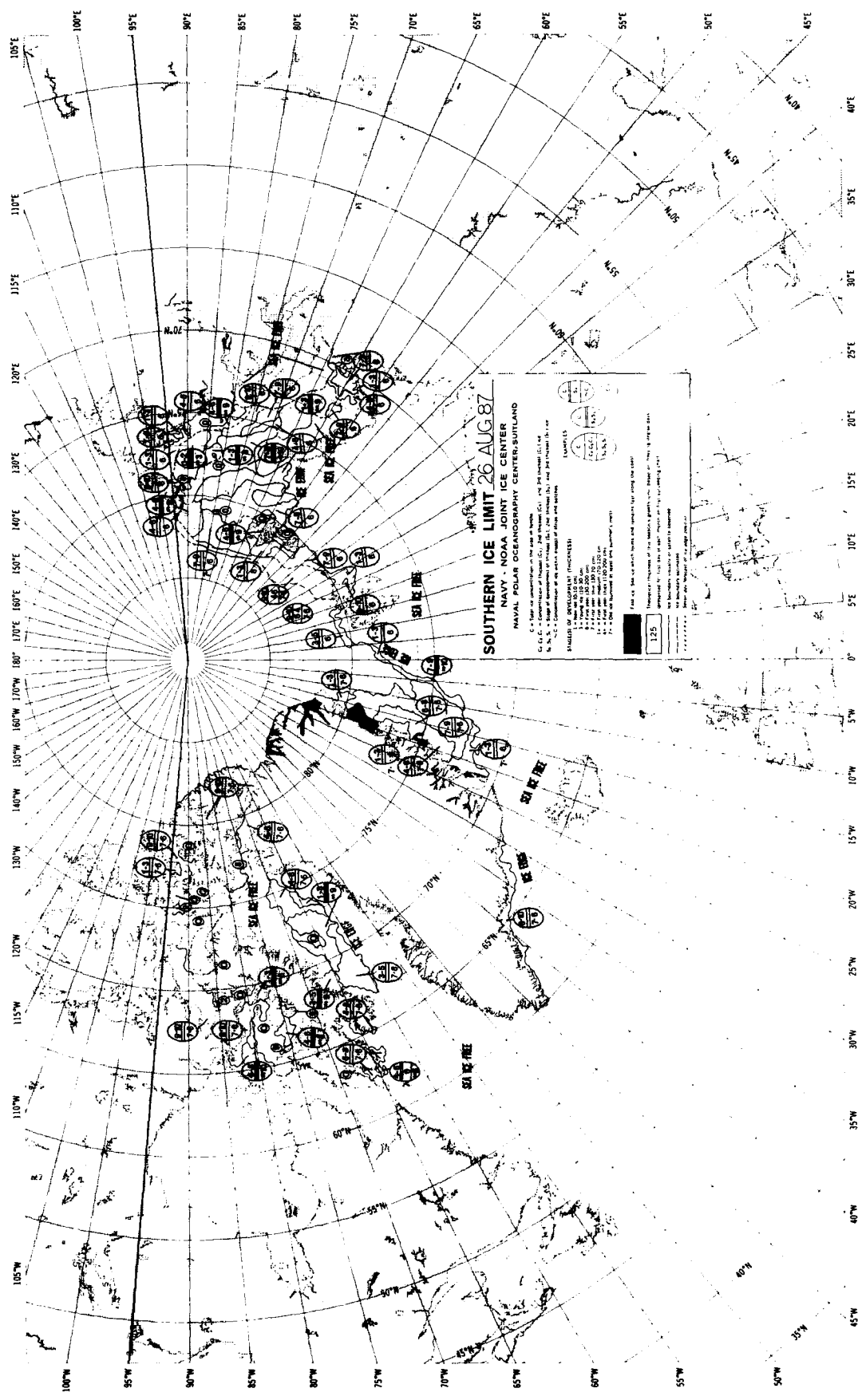
20. The ice limit is shown in light purple on the map.









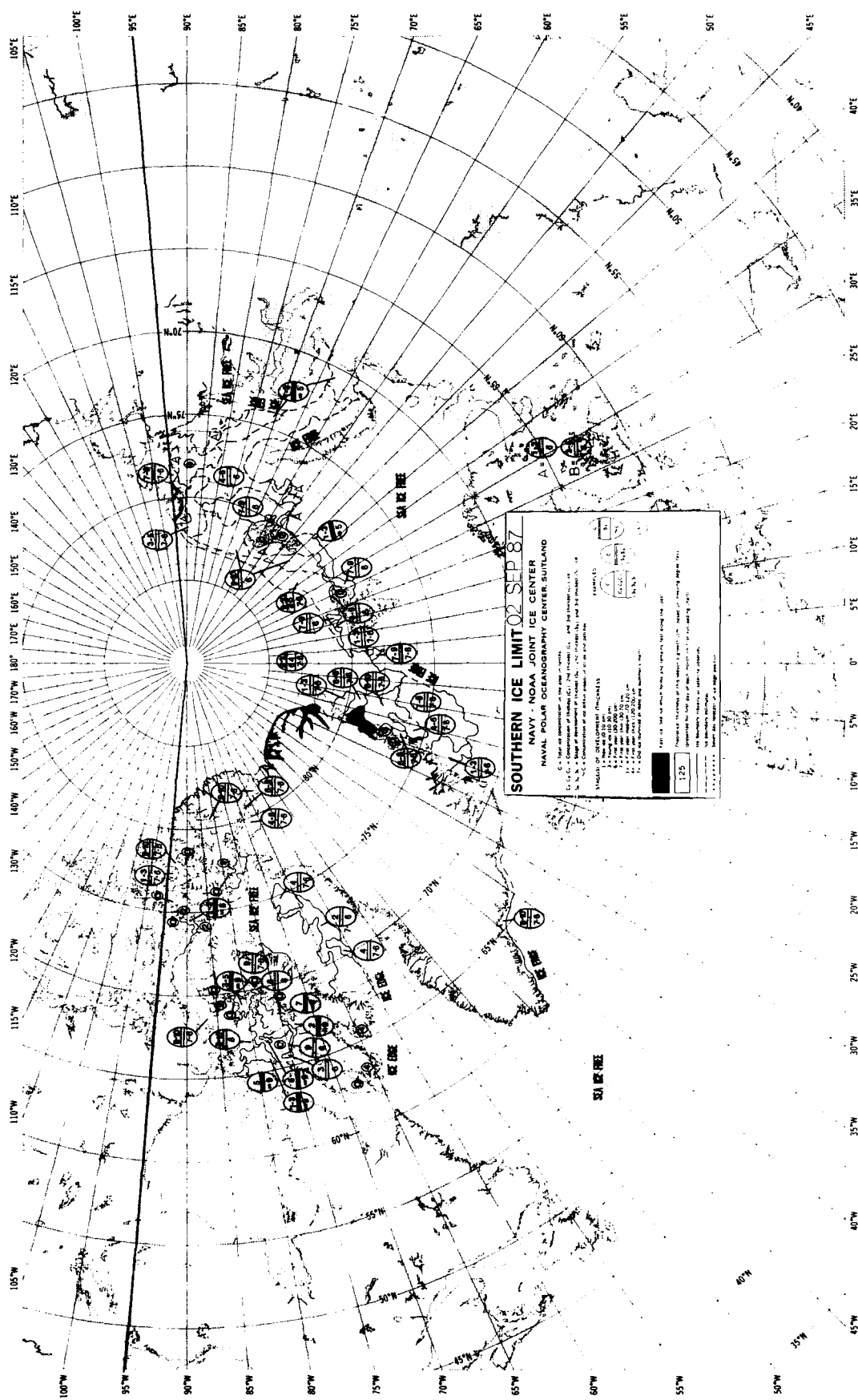


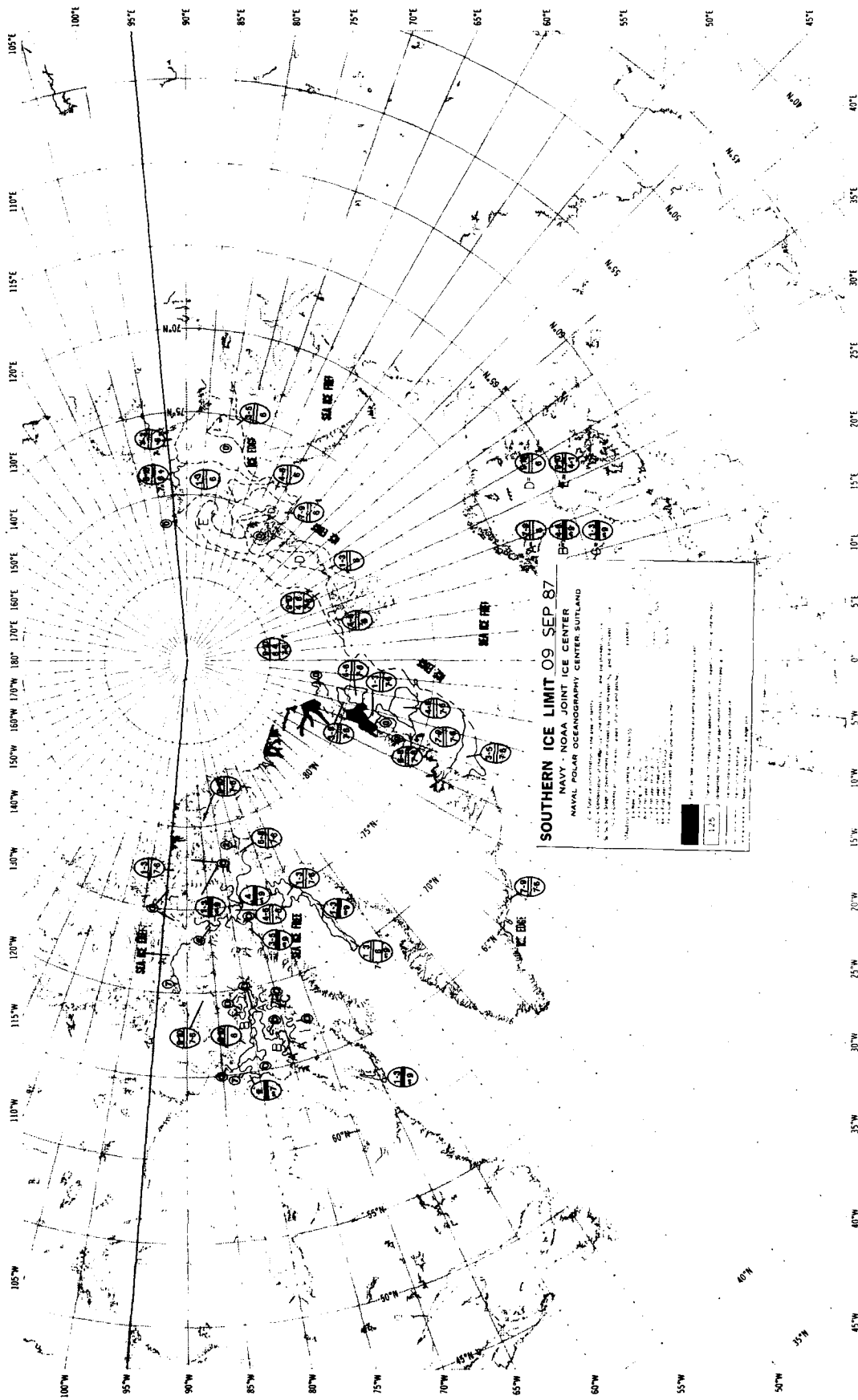
SOUTHERN ICE LIMIT 26 AUG 87
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER-SUITLAND

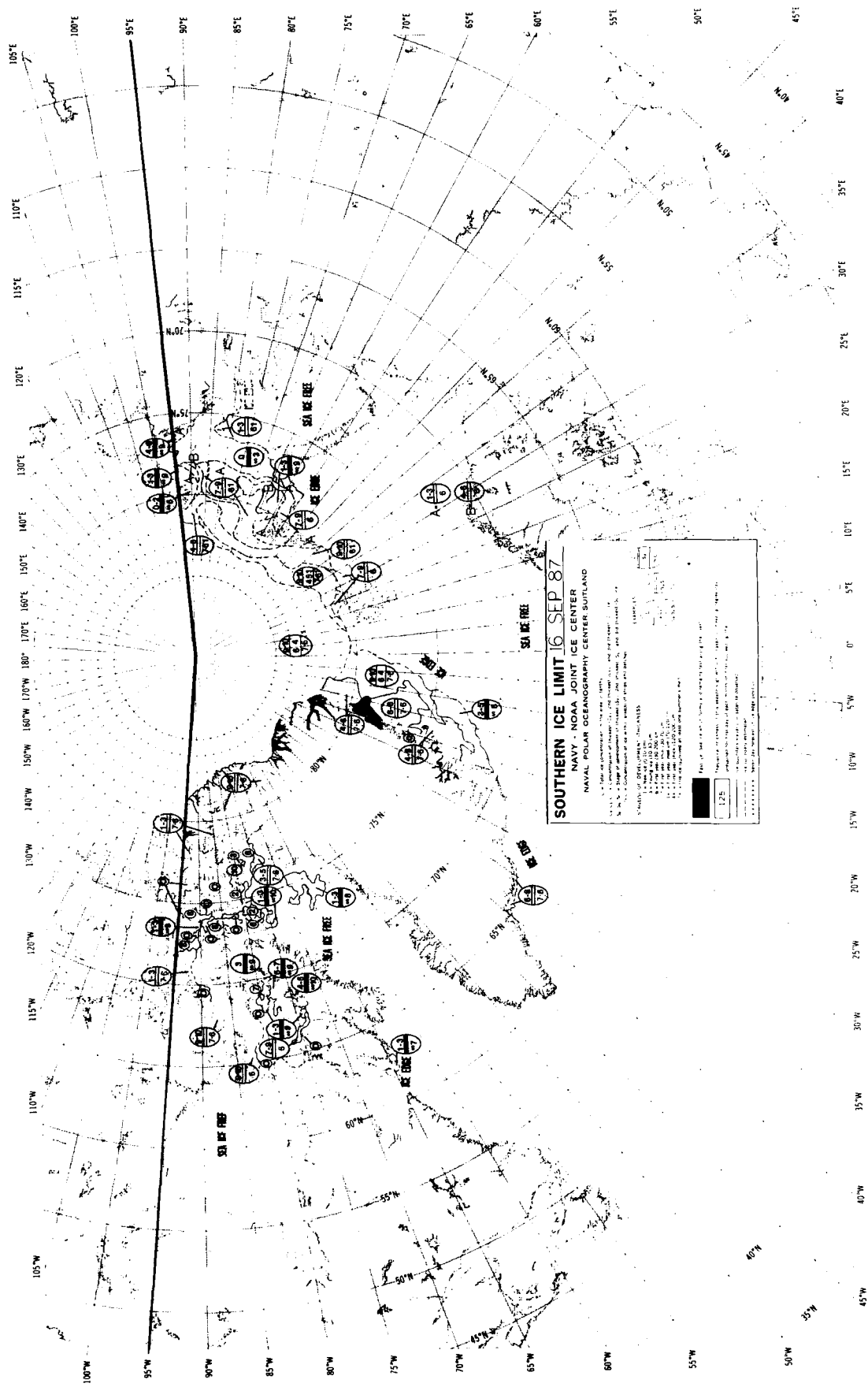
C = Total ice concentration in the ice in %
C₁ C₂ C₃ = Concentration of ice in %
C₁ = 1st thickness (100-150 cm)
C₂ = 2nd thickness (150-200 cm)
C₃ = 3rd thickness (200-300 cm)
C₄ = 4th thickness (300-400 cm)
C₅ = 5th thickness (400-500 cm)
C₆ = 6th thickness (500-600 cm)
C₇ = 7th thickness (600-700 cm)
C₈ = 8th thickness (700-800 cm)
C₉ = 9th thickness (800-900 cm)
C₁₀ = 10th thickness (900-1000 cm)

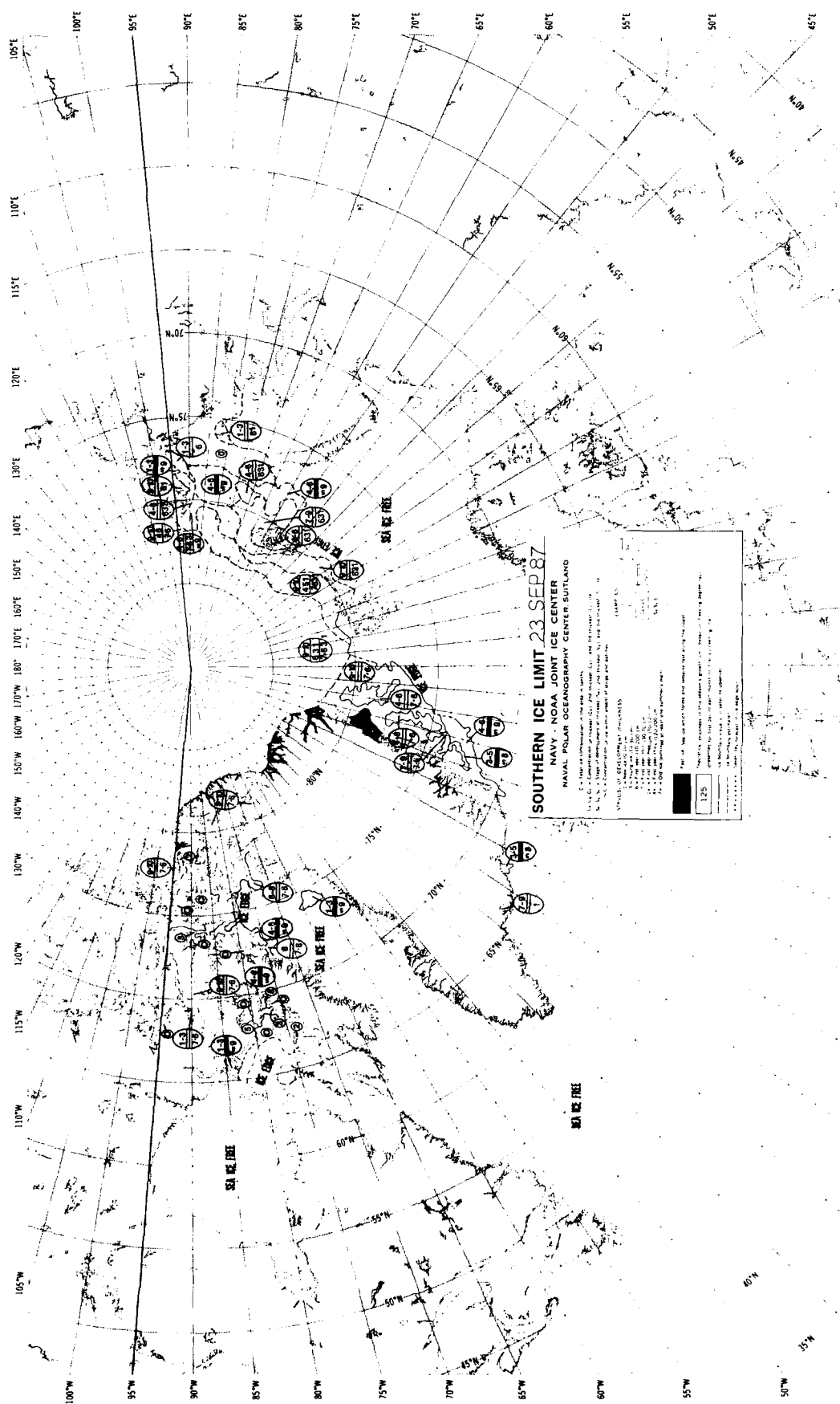
VALUES OF DEVELOPMENT (THICKNESS)
1 = 100-150 cm
2 = 150-200 cm
3 = 200-300 cm
4 = 300-400 cm
5 = 400-500 cm
6 = 500-600 cm
7 = 600-700 cm
8 = 700-800 cm
9 = 800-900 cm
10 = 900-1000 cm

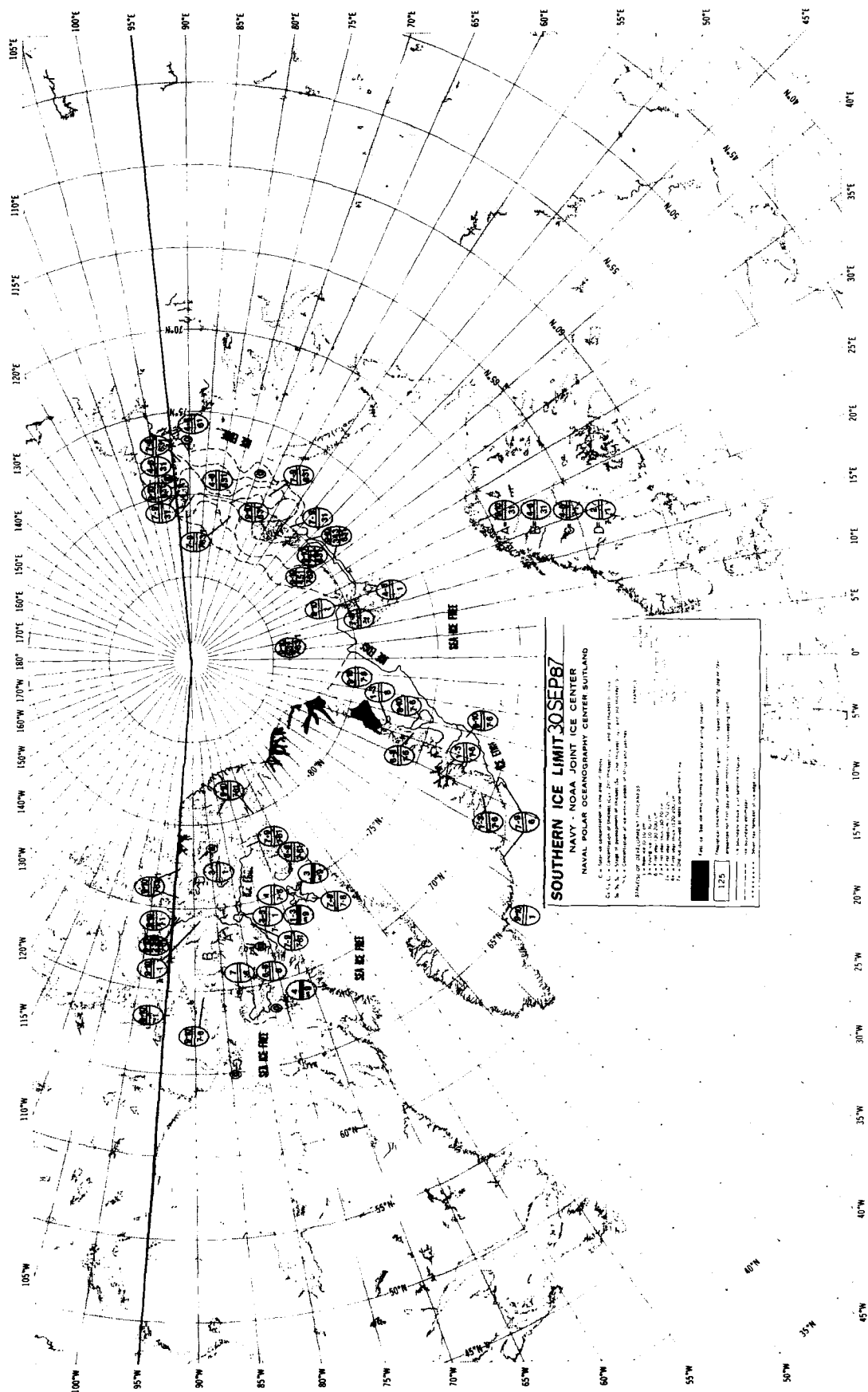
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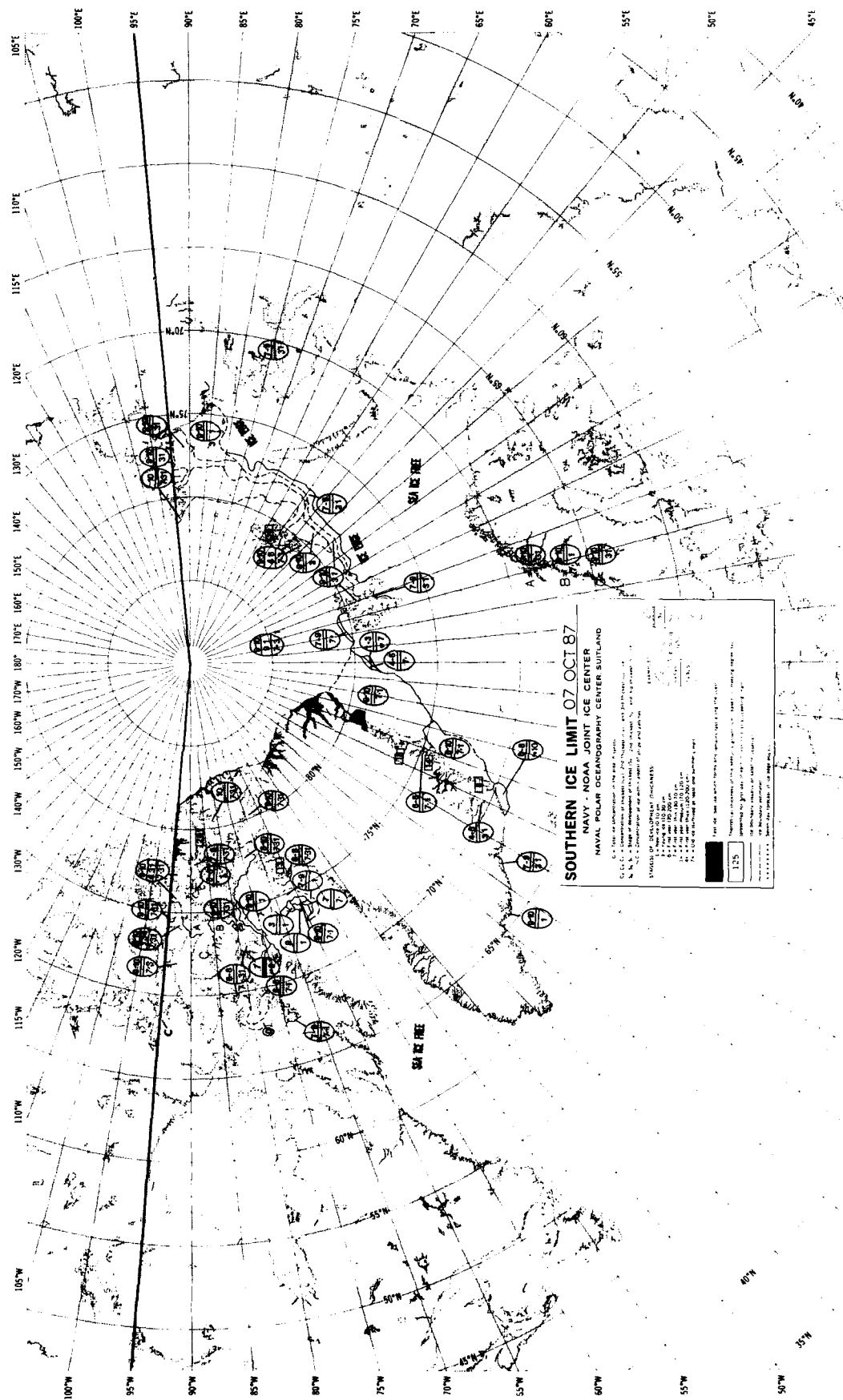


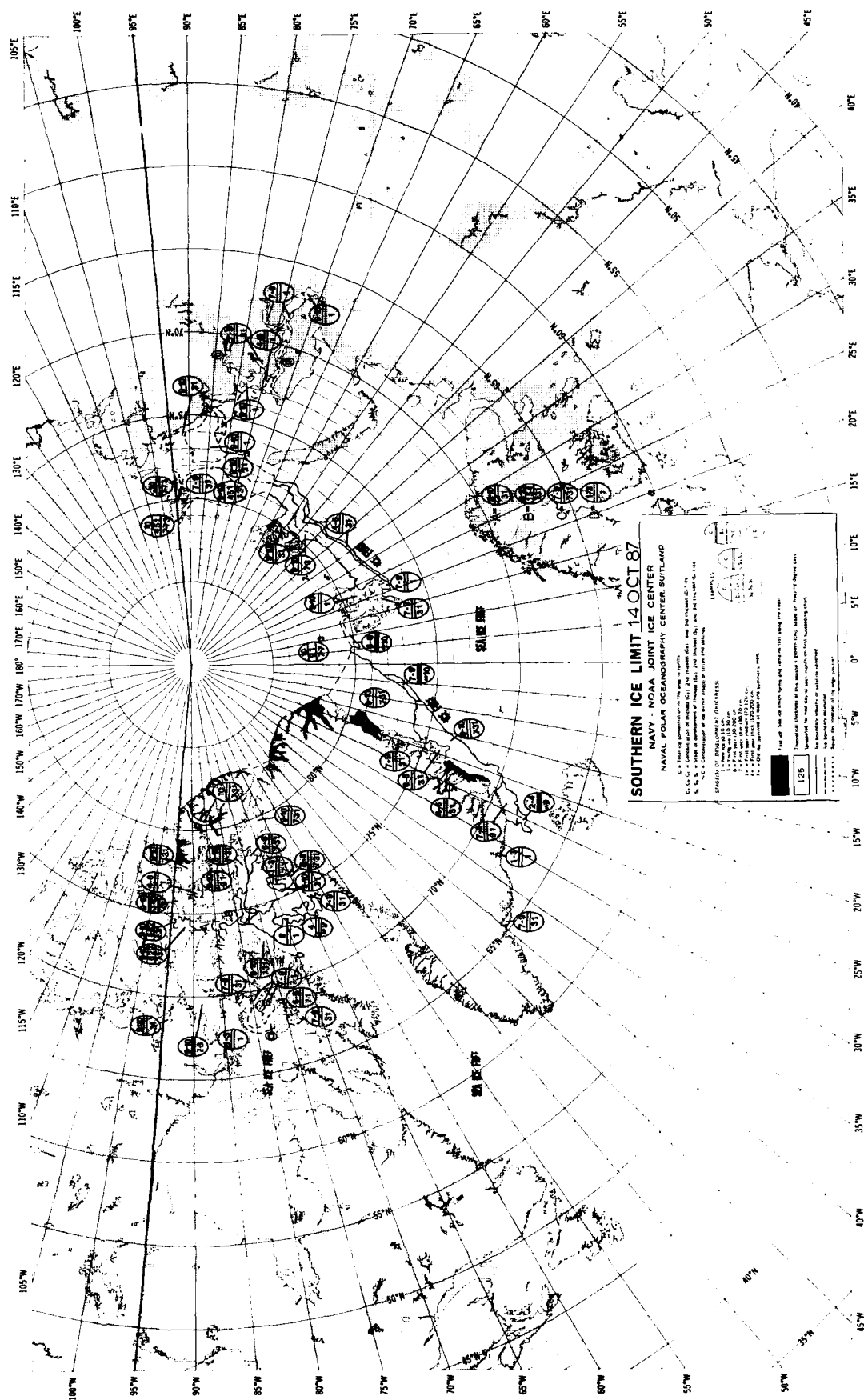


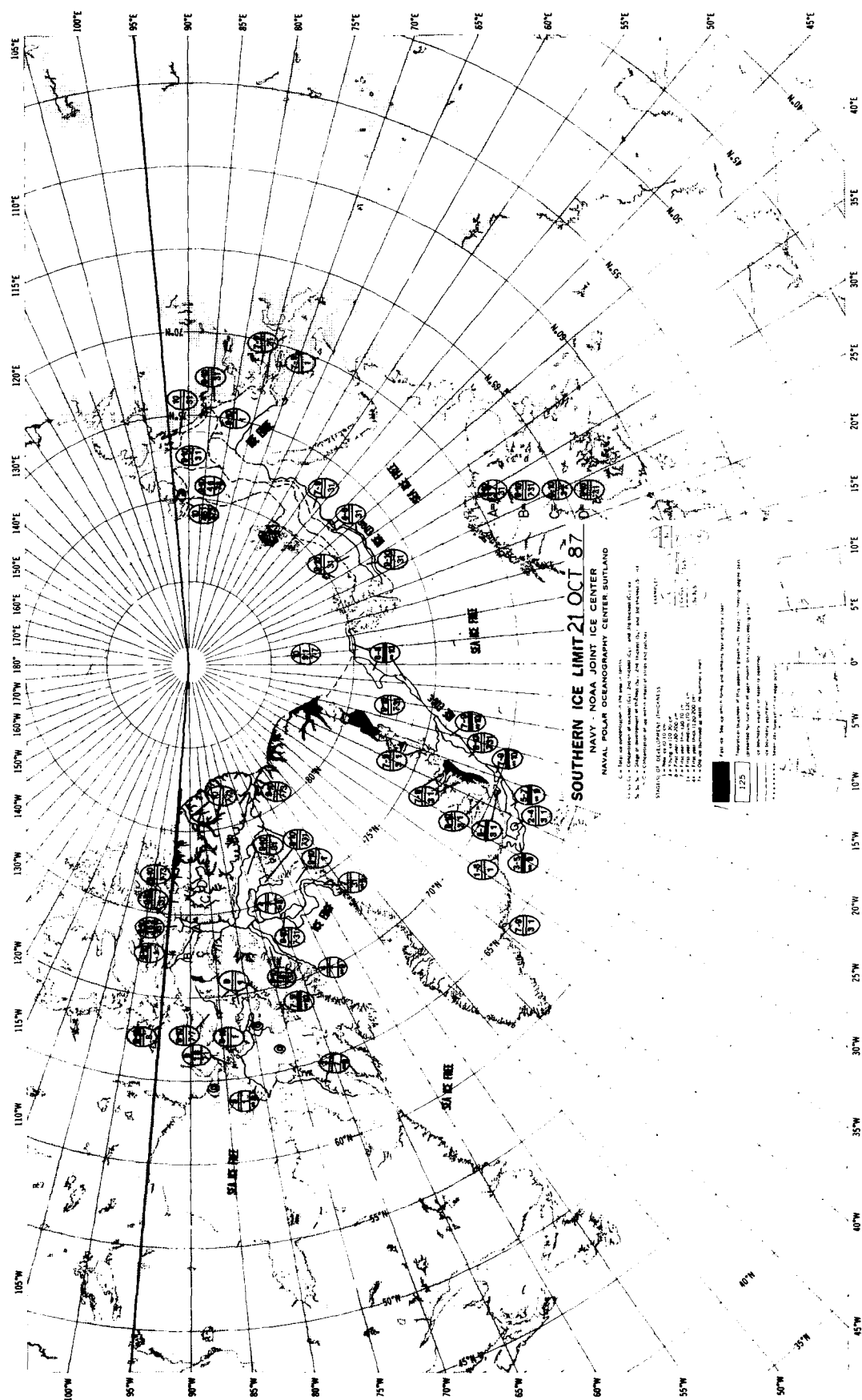


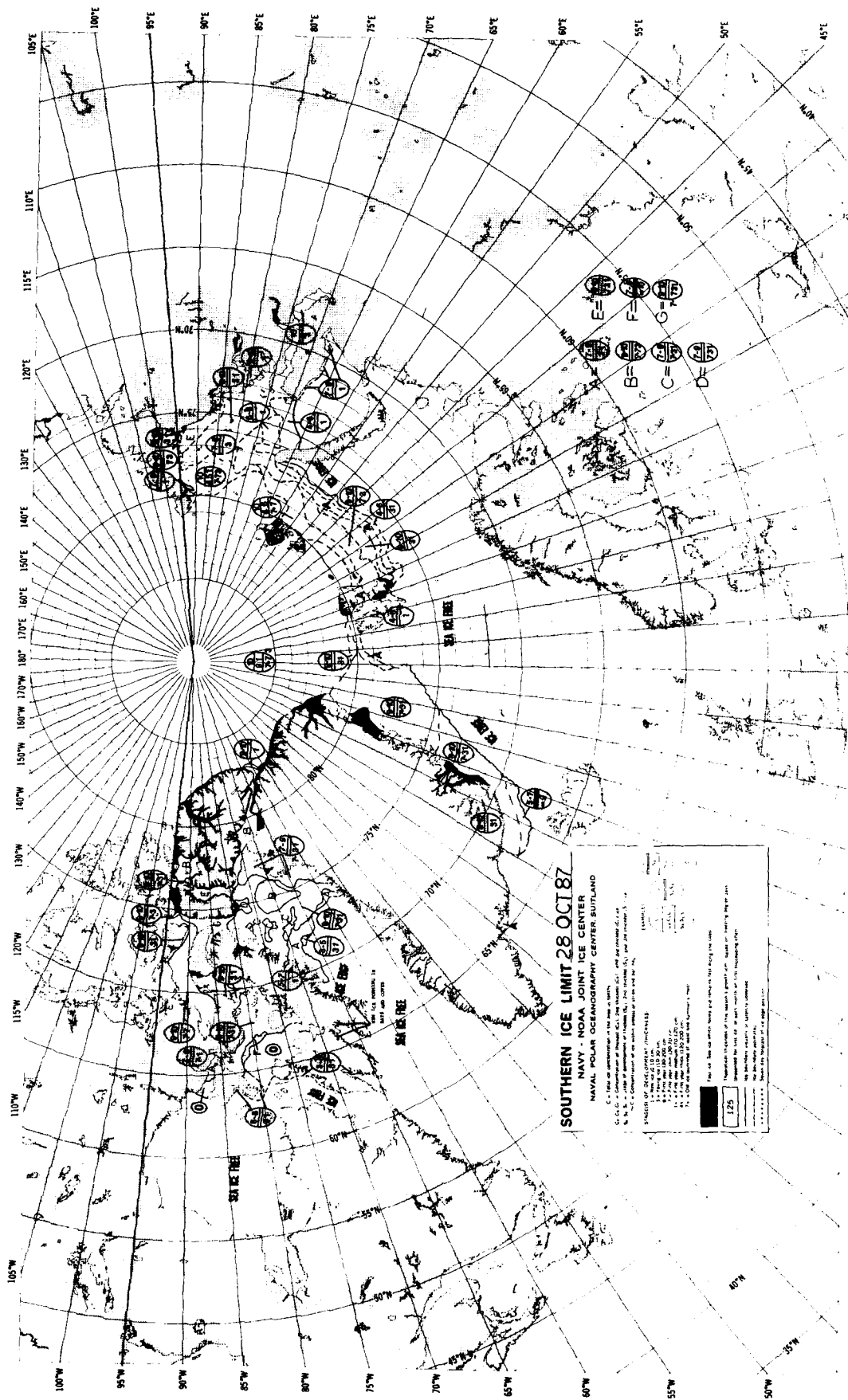


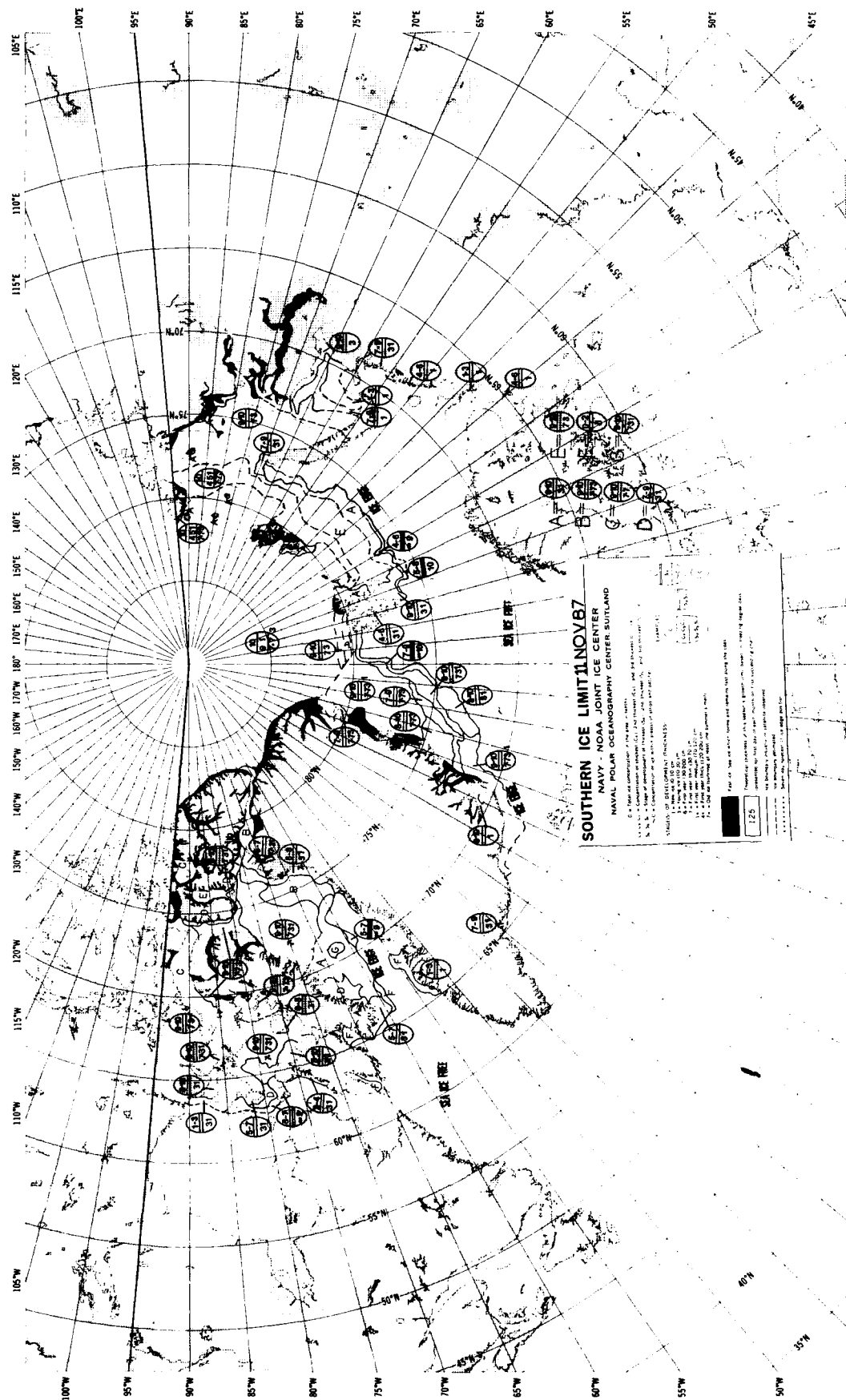


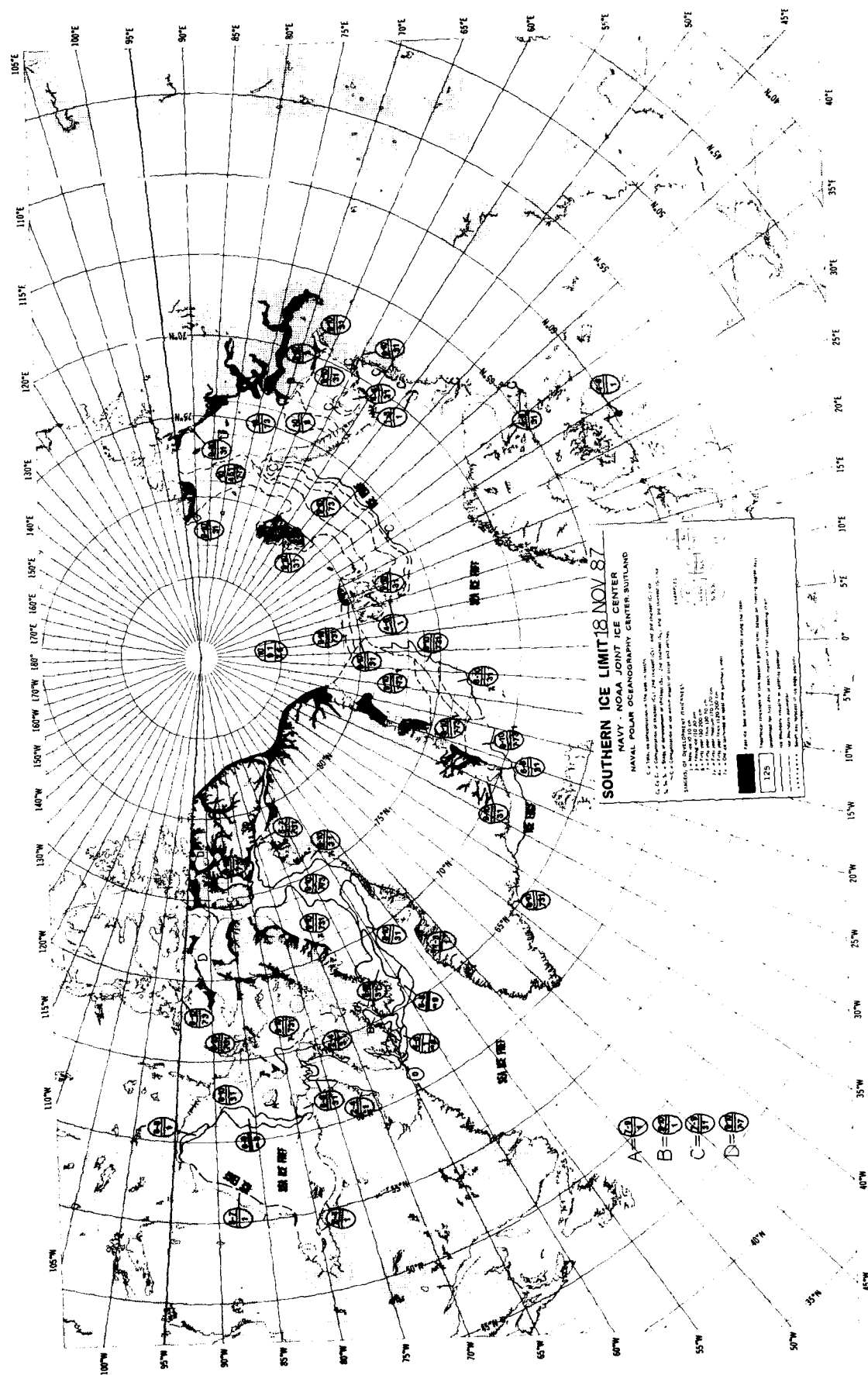


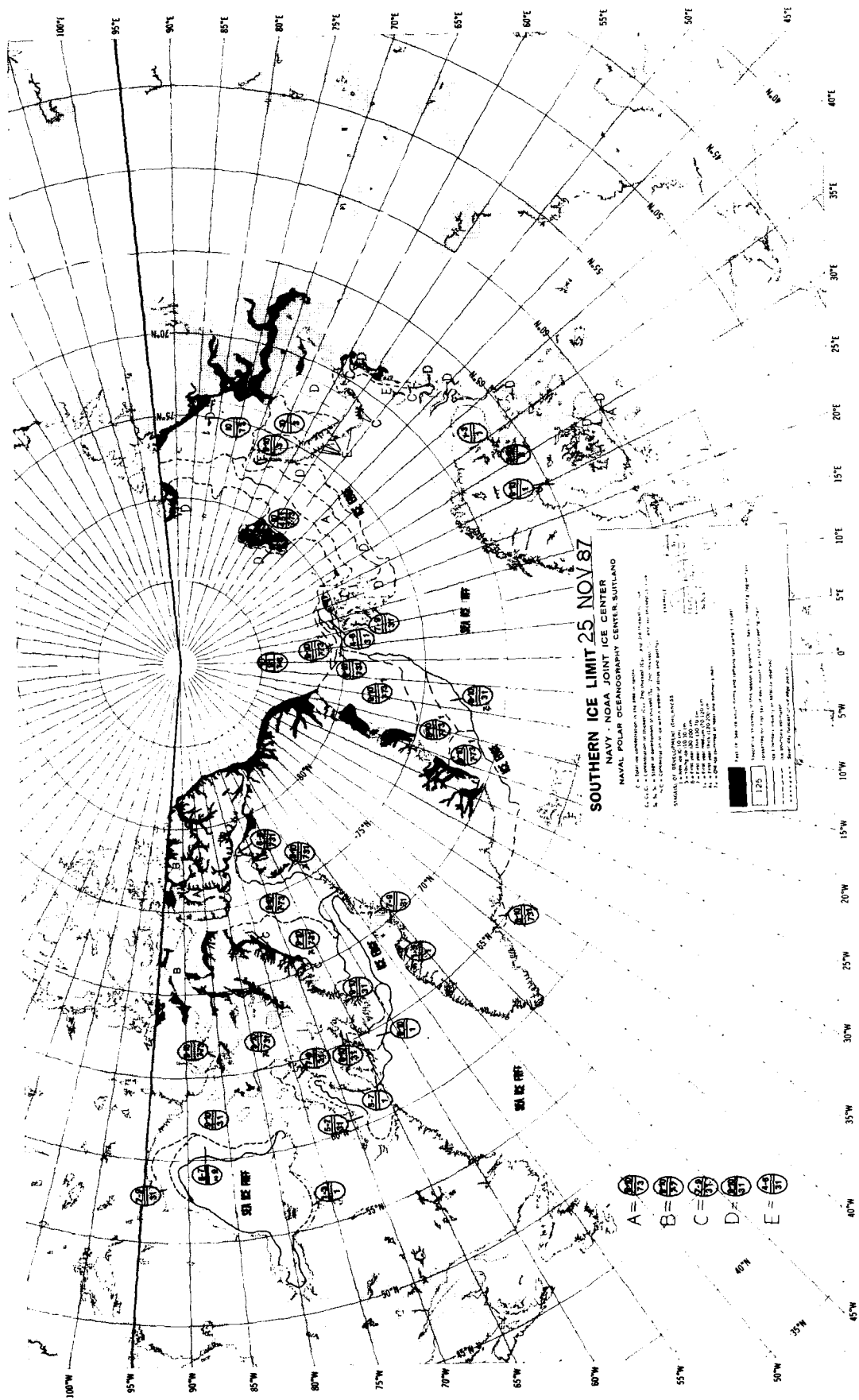


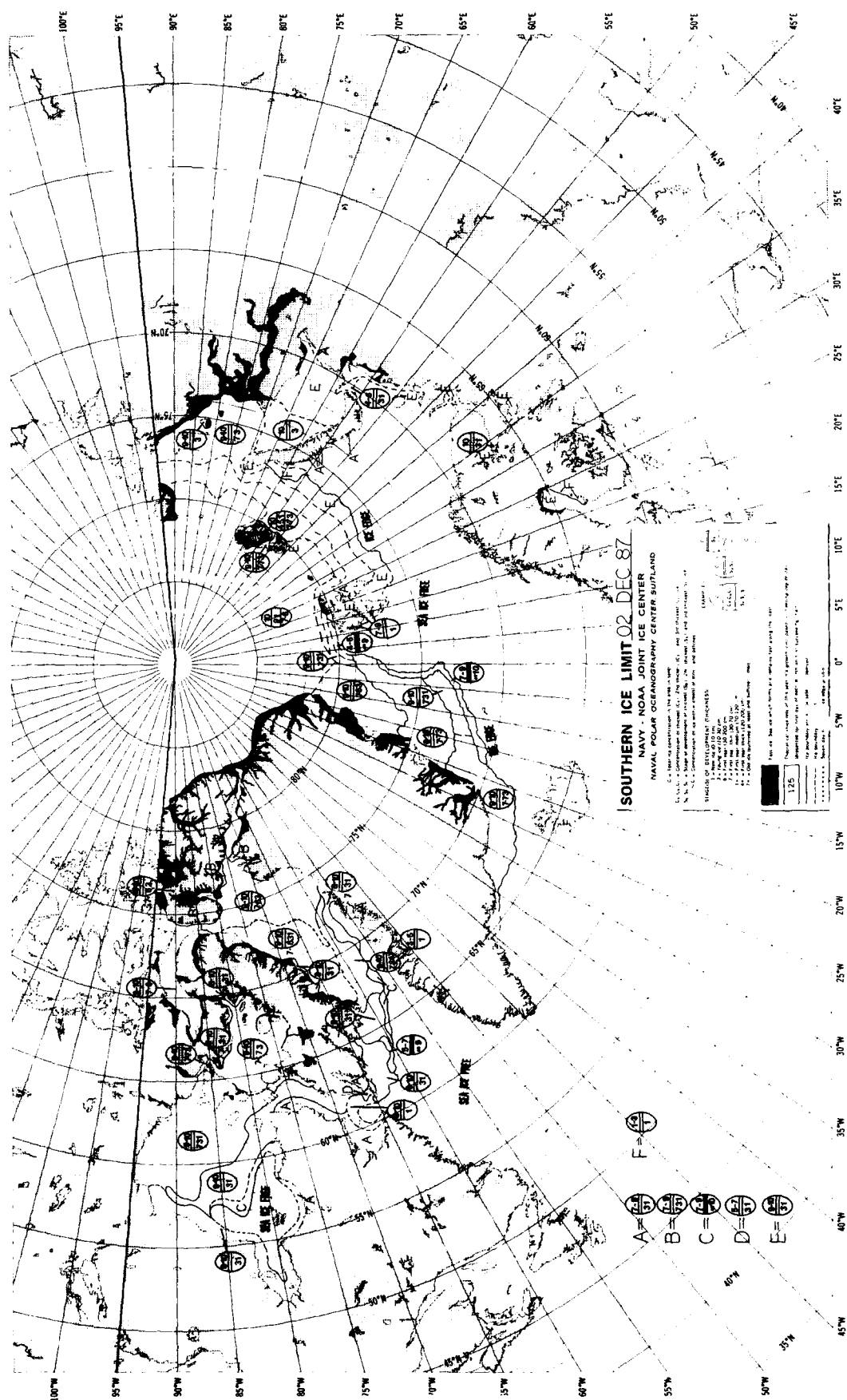


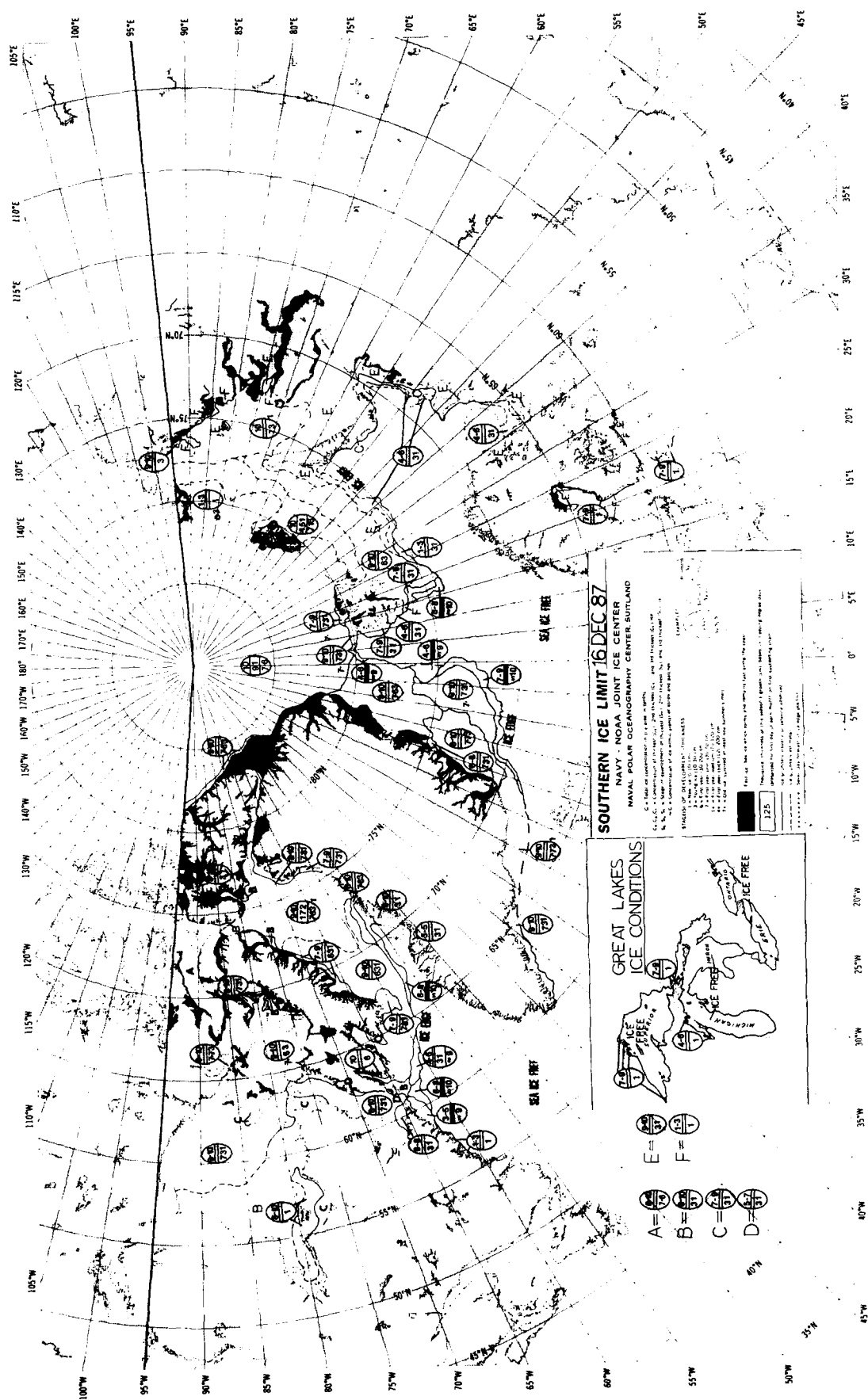


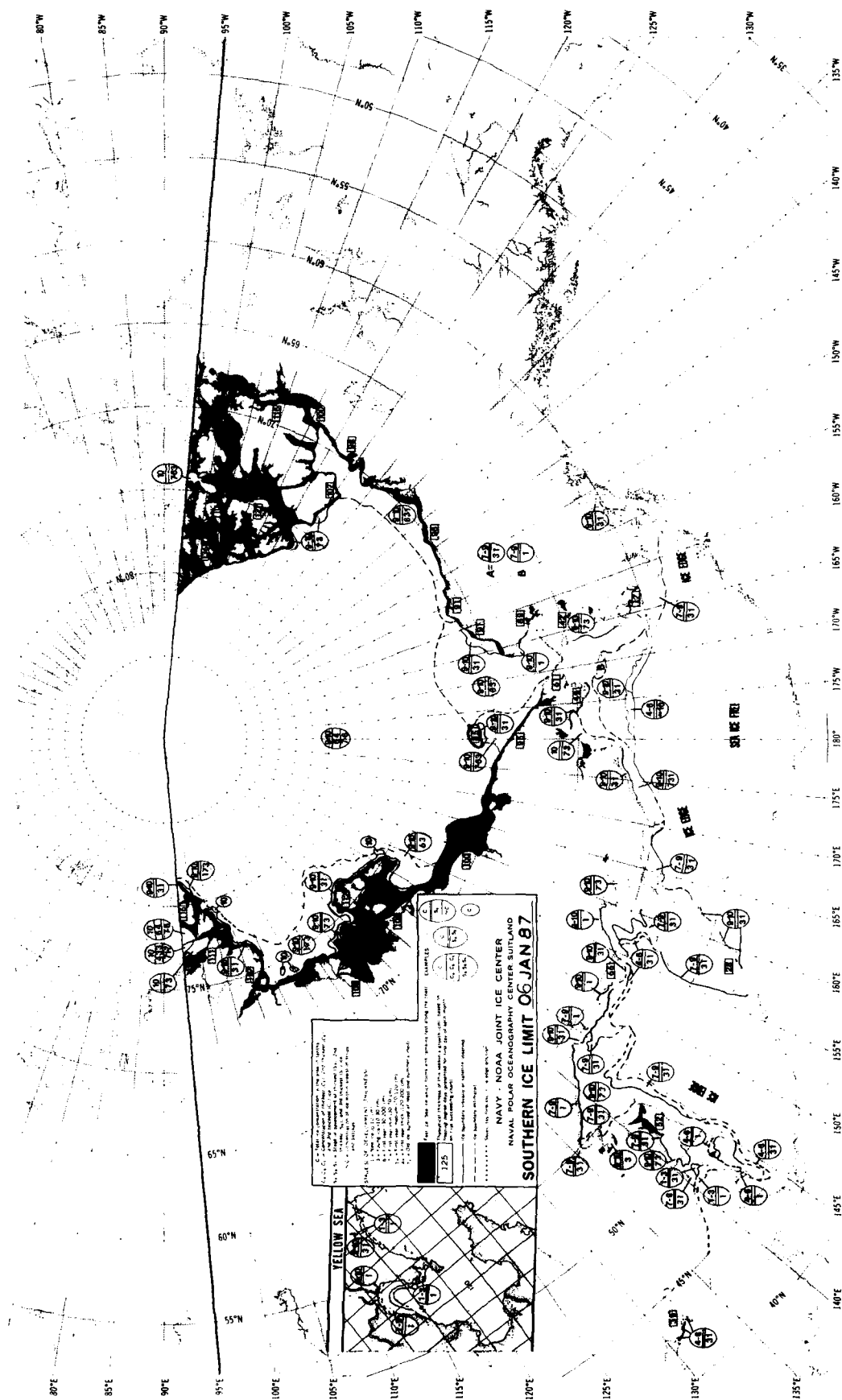


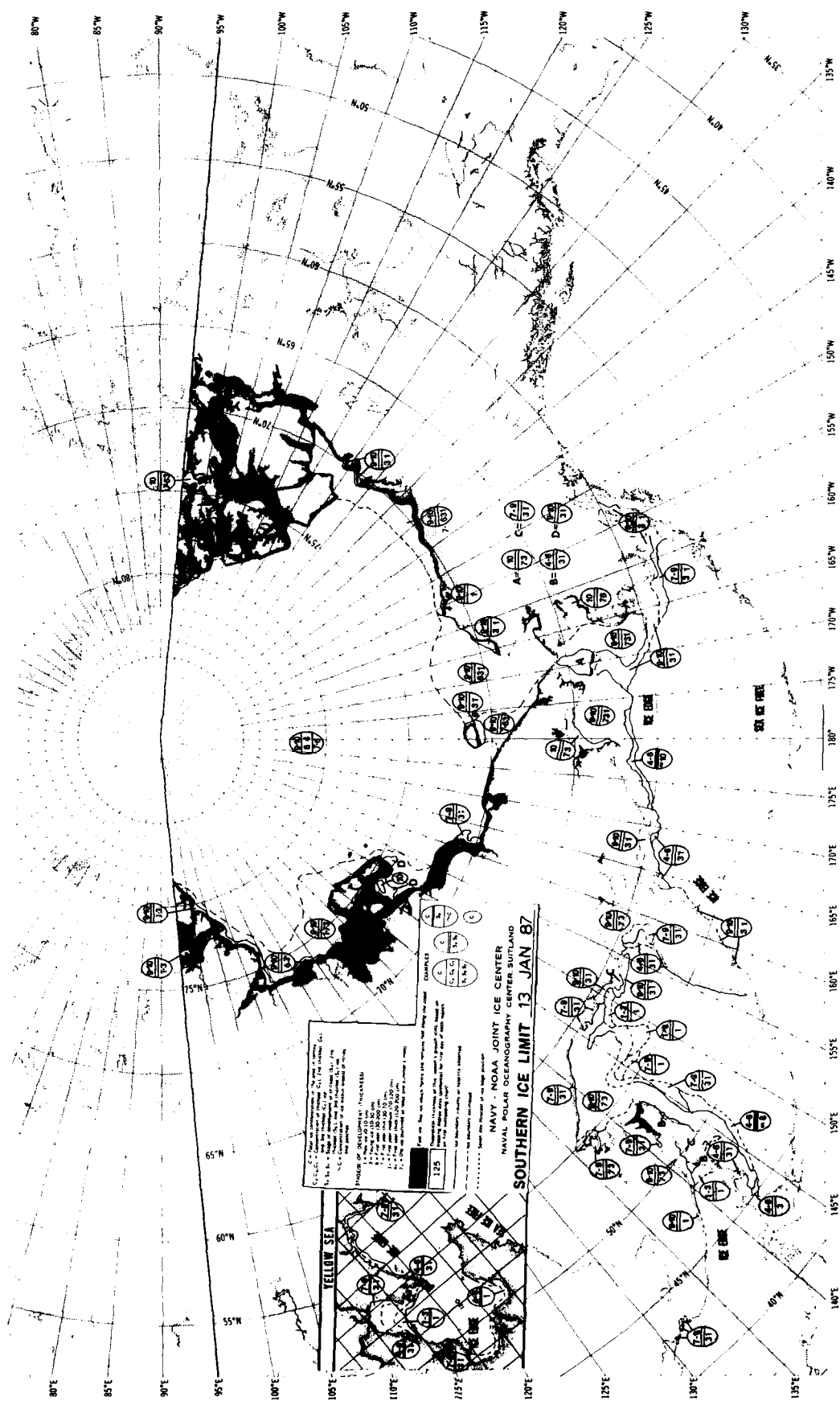


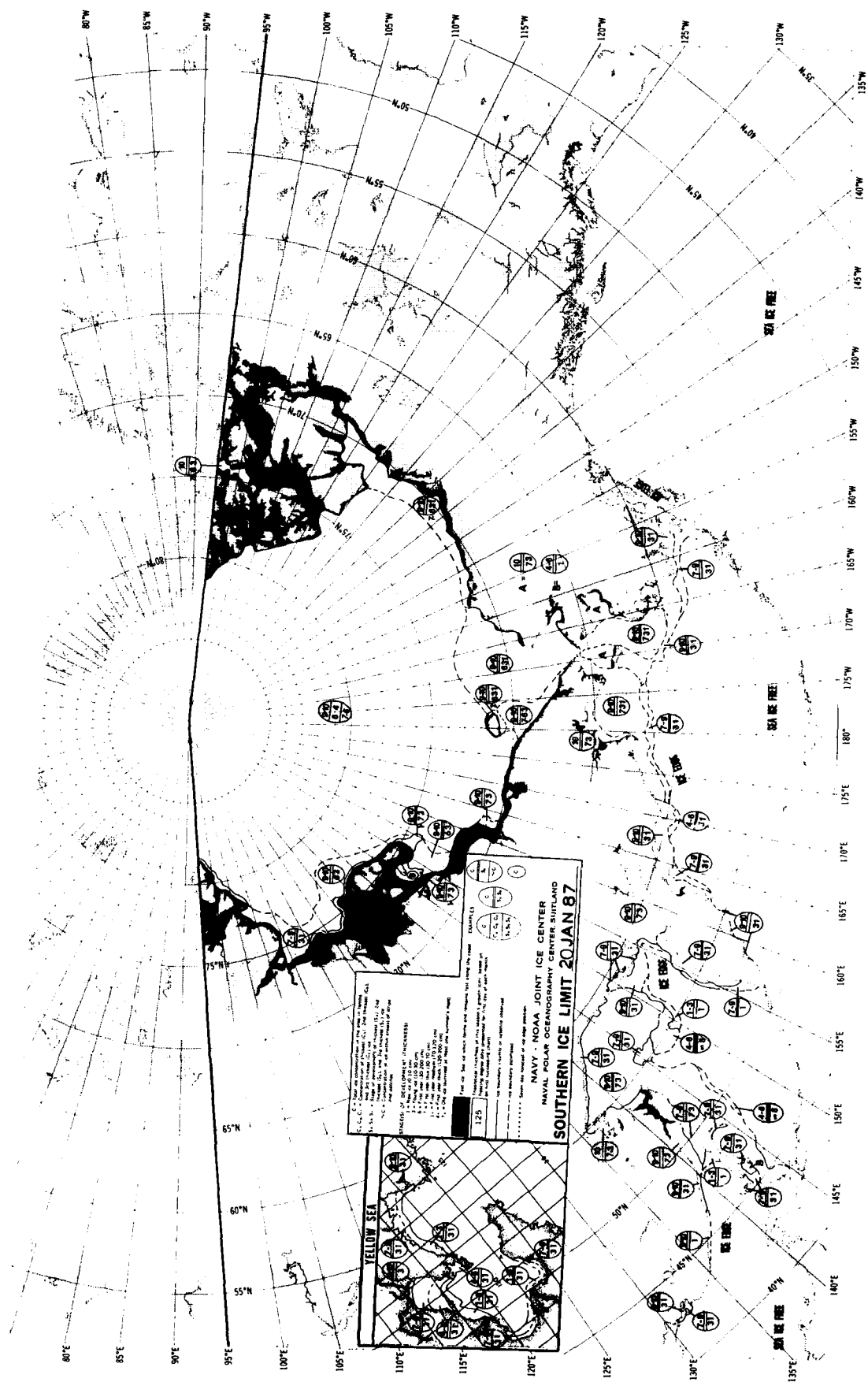


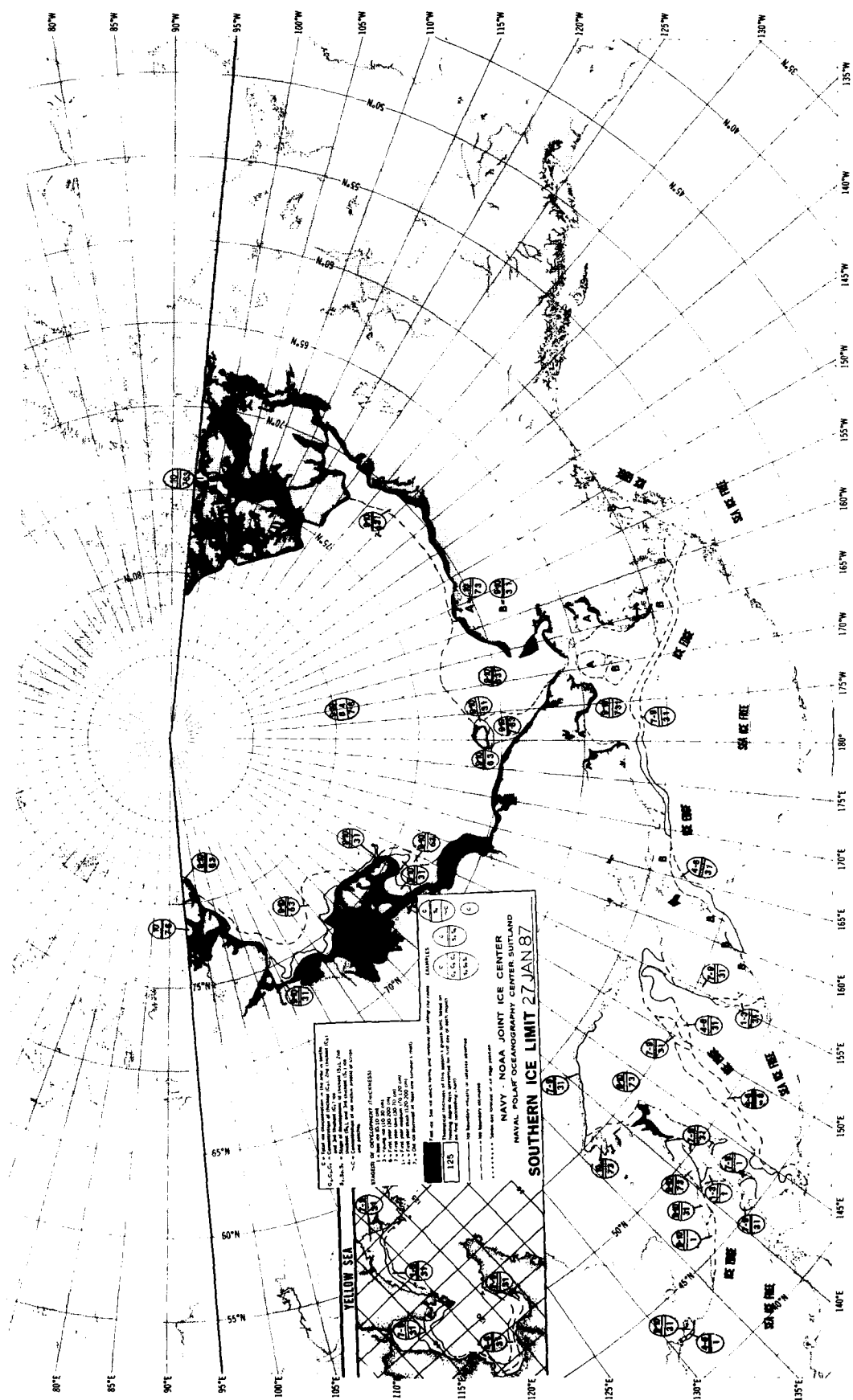


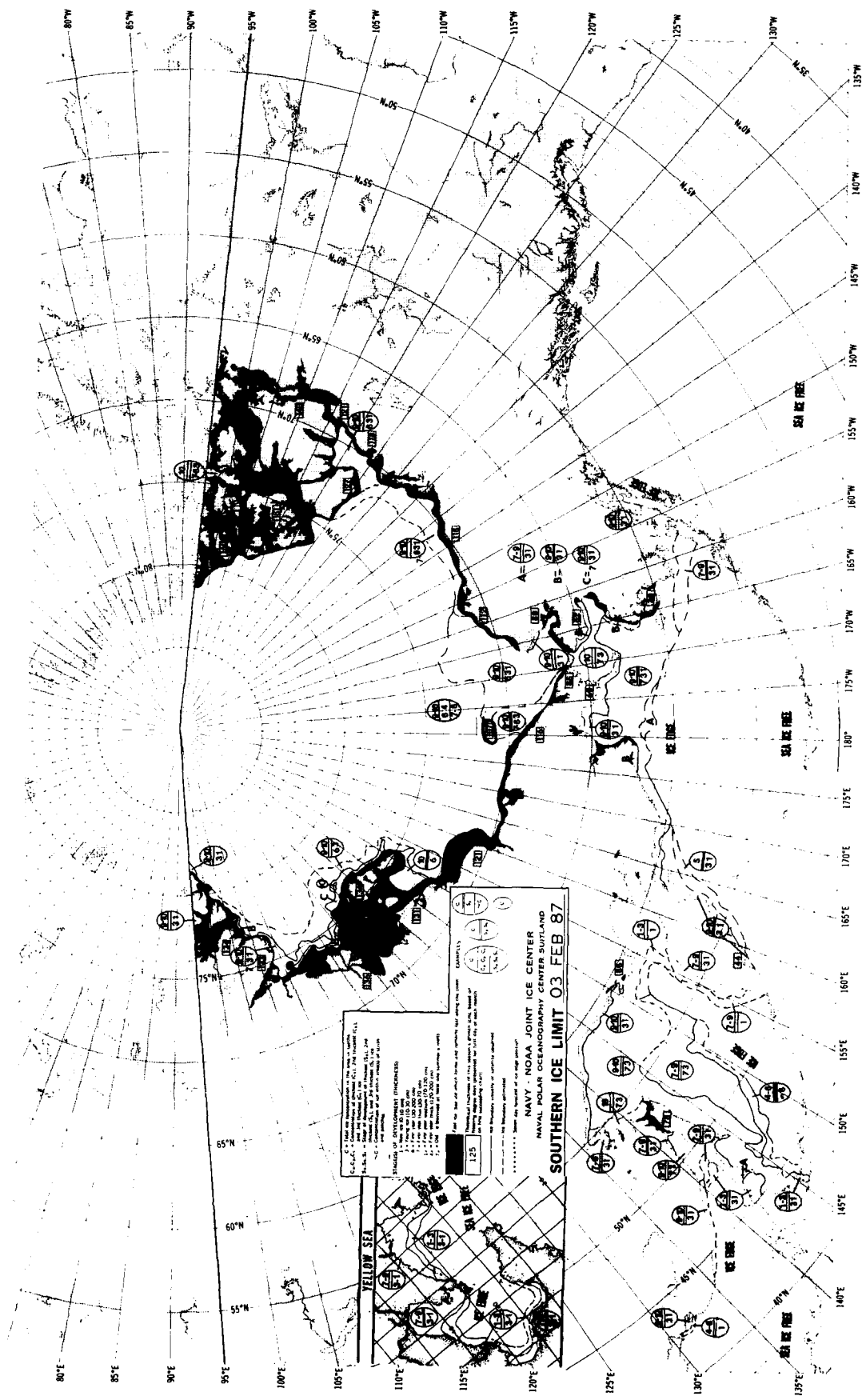












NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUTLAND
SOUTHERN ICE LIMIT 03 FEB 87

LEGEND

1. Ice thickness (meters) indicated by numbers in symbols: 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, 1000.

2. Ice concentration (percent) indicated by symbols: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100.

3. Ice type (indicated by symbols): 1. Sea ice, 2. Land ice, 3. Icebergs, 4. Ice floes, 5. Ice chunks, 6. Ice fragments, 7. Ice debris, 8. Ice shavings, 9. Ice chips, 10. Ice dust.

4. Ice age (indicated by symbols): 1. Young ice, 2. First-year ice, 3. Second-year ice, 4. Multi-year ice, 5. Old ice.

5. Ice motion (indicated by symbols): 1. Drift, 2. Current, 3. Wind, 4. Wave, 5. Tide, 6. Current, 7. Wind, 8. Wave, 9. Tide, 10. Current.

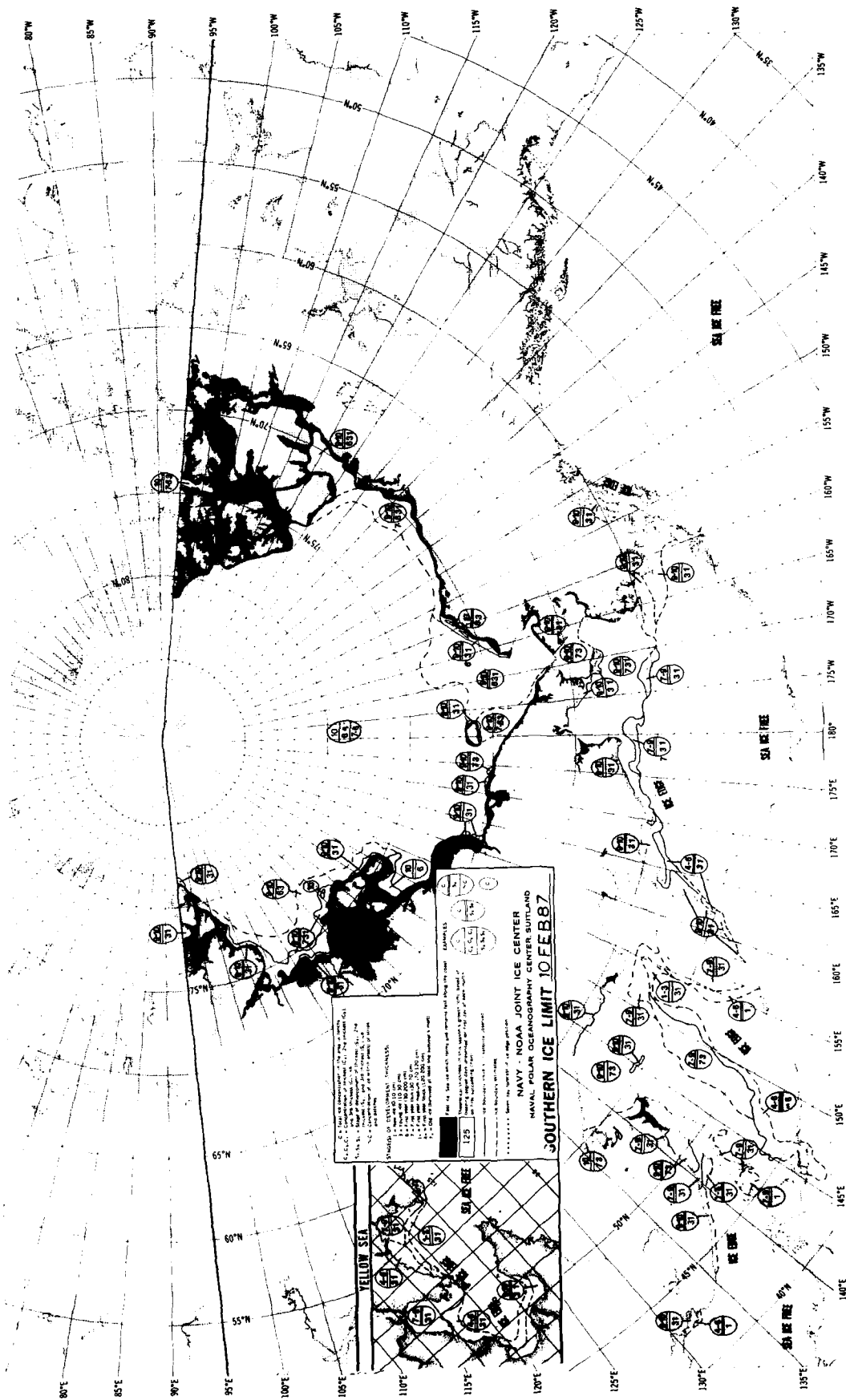
6. Ice motion (indicated by symbols): 1. Drift, 2. Current, 3. Wind, 4. Wave, 5. Tide, 6. Current, 7. Wind, 8. Wave, 9. Tide, 10. Current.

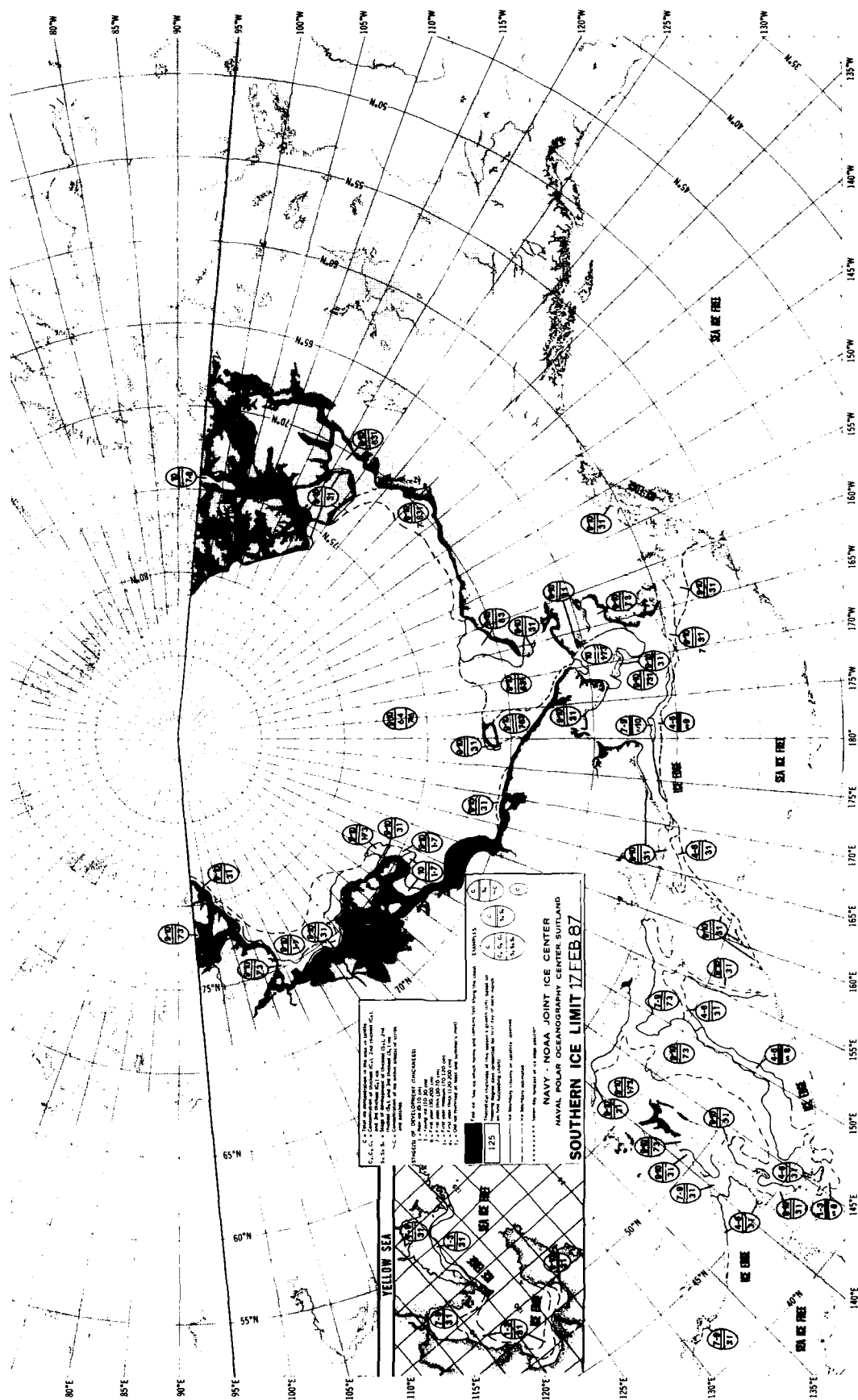
7. Ice motion (indicated by symbols): 1. Drift, 2. Current, 3. Wind, 4. Wave, 5. Tide, 6. Current, 7. Wind, 8. Wave, 9. Tide, 10. Current.

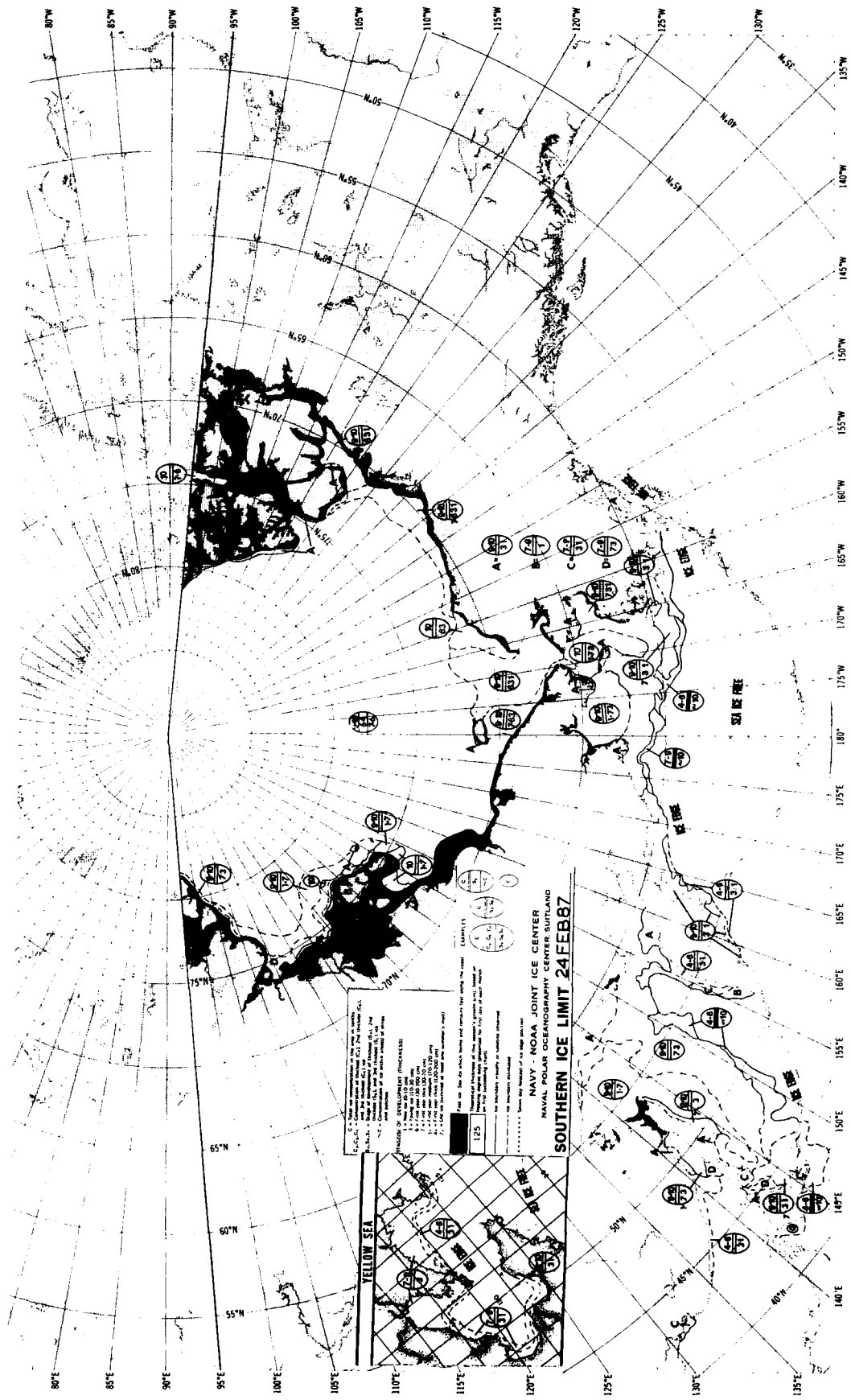
8. Ice motion (indicated by symbols): 1. Drift, 2. Current, 3. Wind, 4. Wave, 5. Tide, 6. Current, 7. Wind, 8. Wave, 9. Tide, 10. Current.

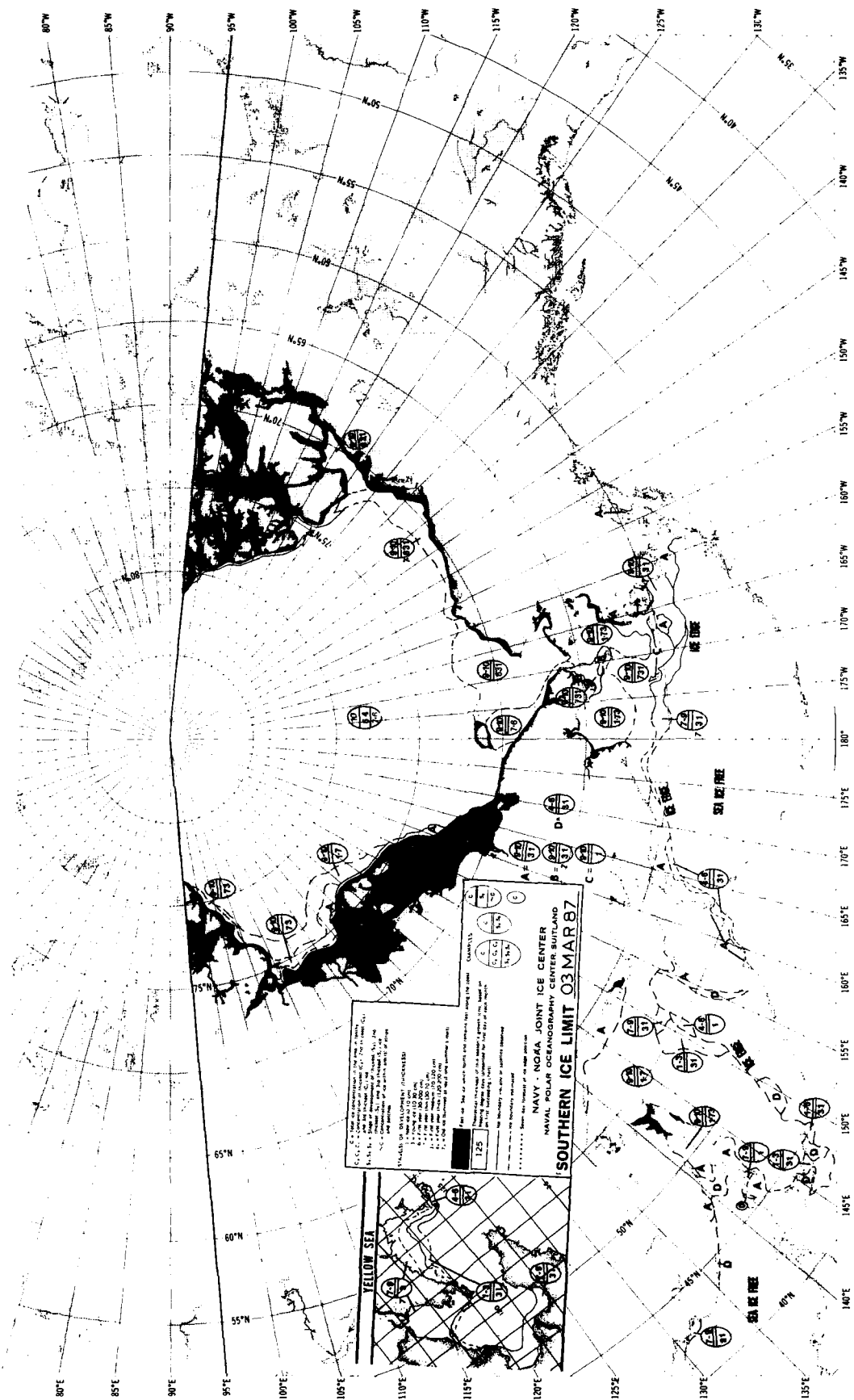
9. Ice motion (indicated by symbols): 1. Drift, 2. Current, 3. Wind, 4. Wave, 5. Tide, 6. Current, 7. Wind, 8. Wave, 9. Tide, 10. Current.

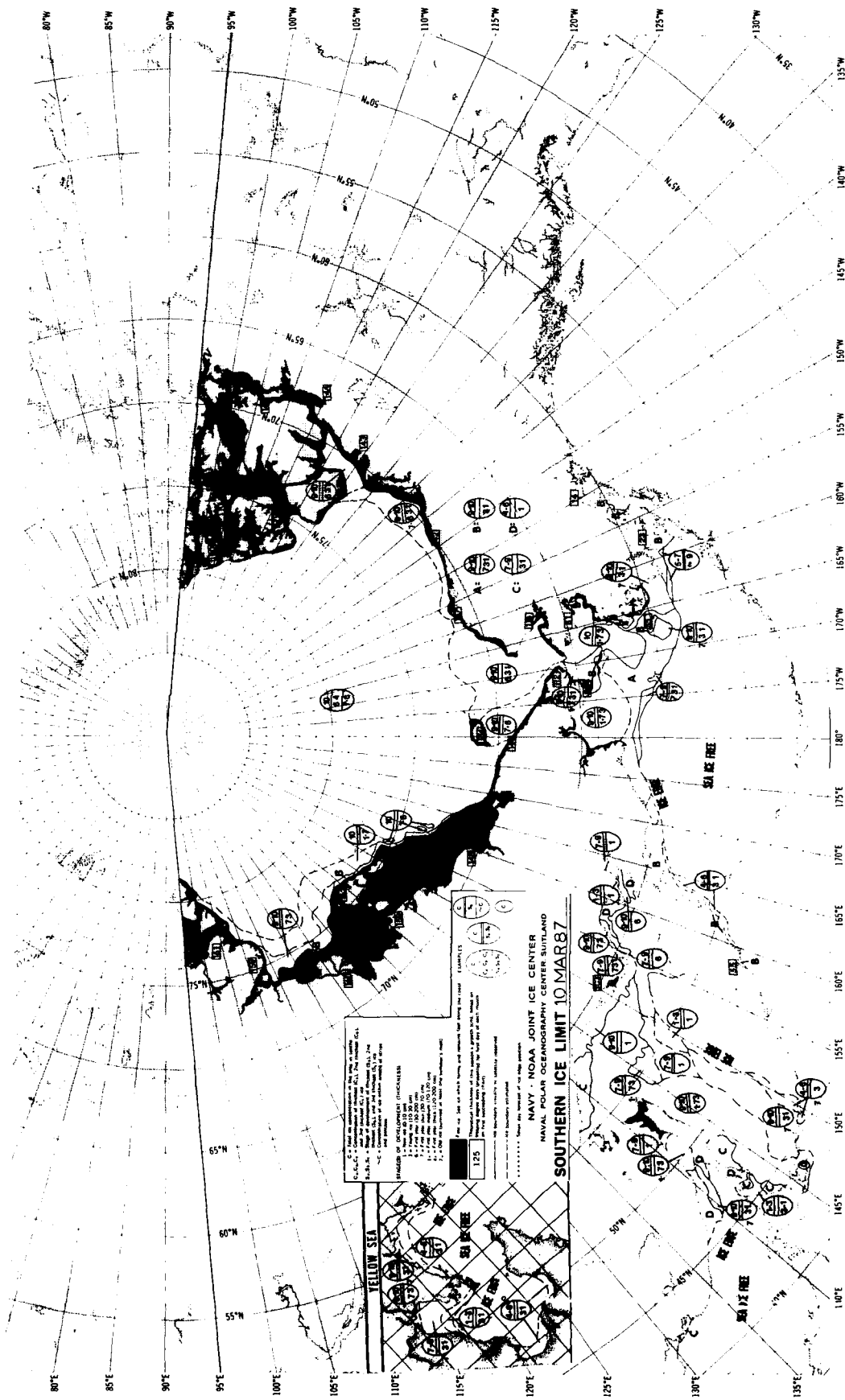
10. Ice motion (indicated by symbols): 1. Drift, 2. Current, 3. Wind, 4. Wave, 5. Tide, 6. Current, 7. Wind, 8. Wave, 9. Tide, 10. Current.

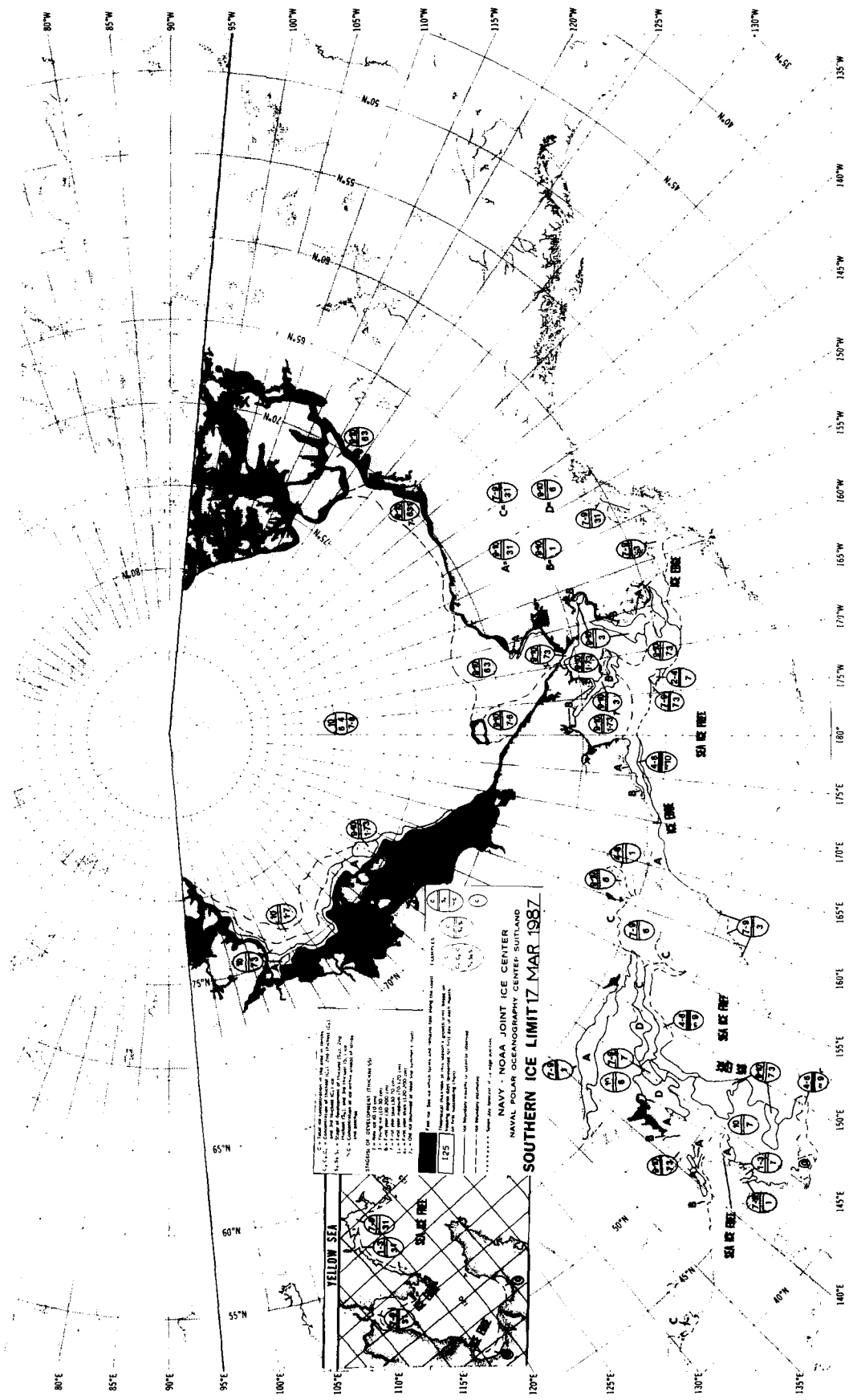


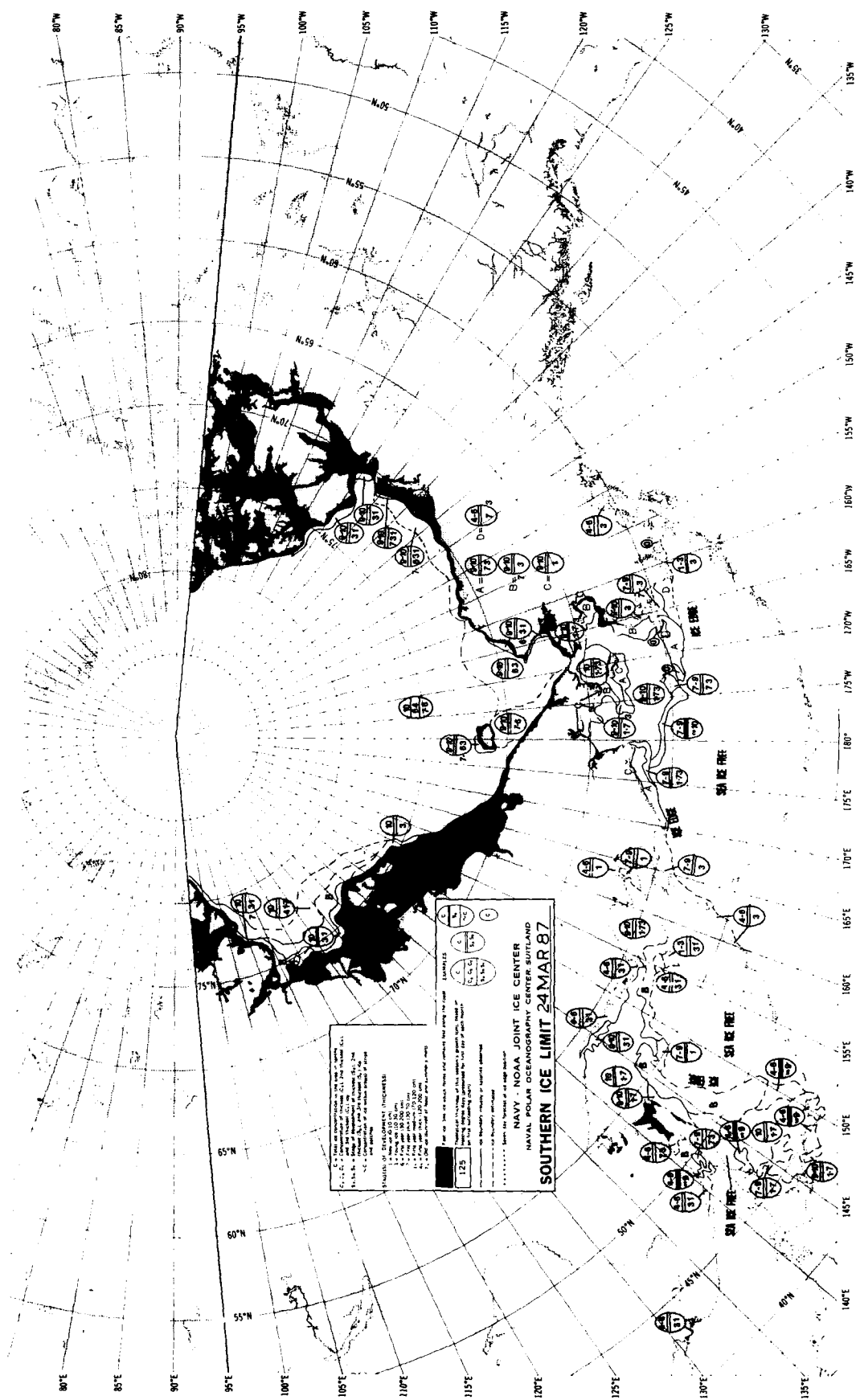


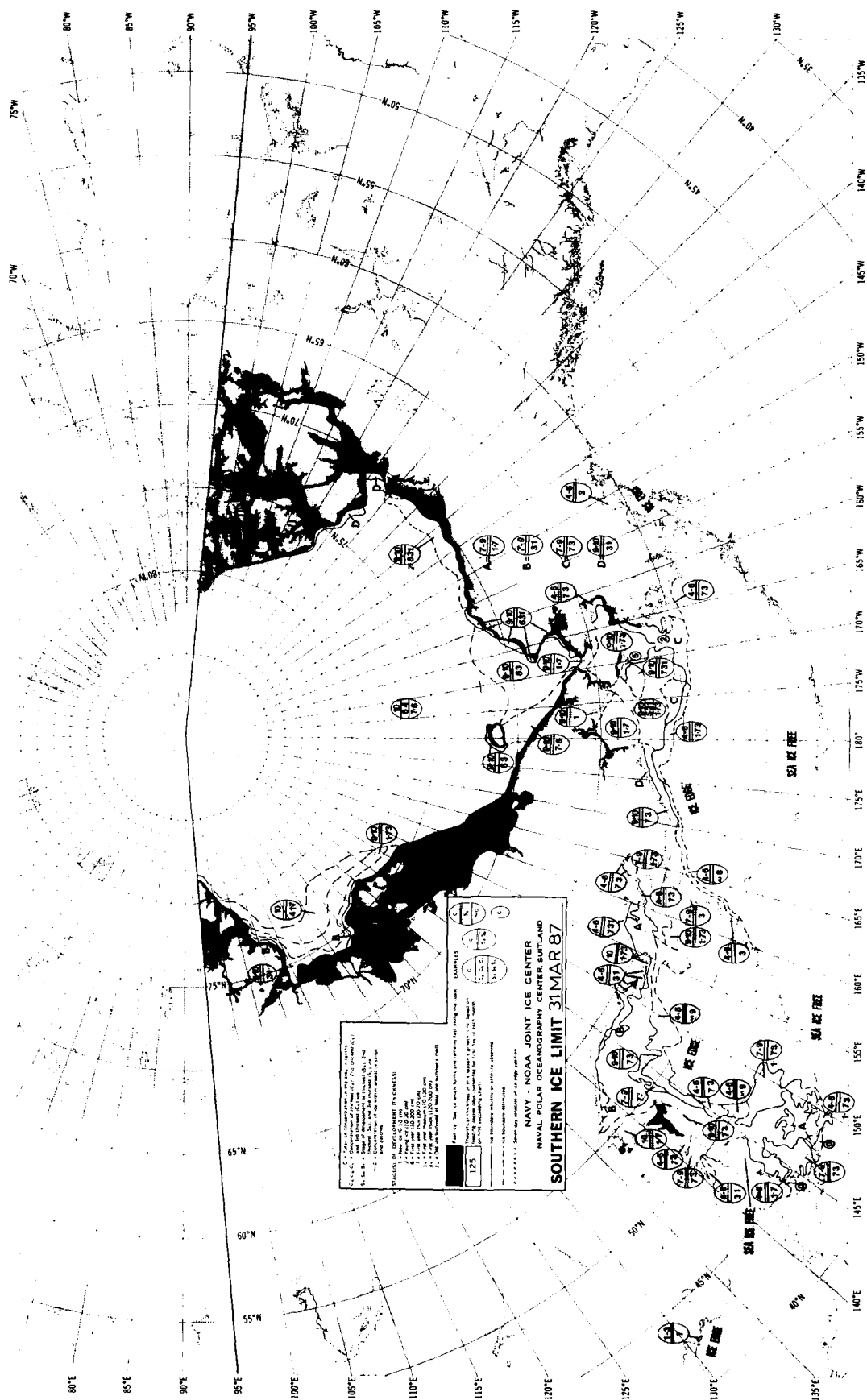


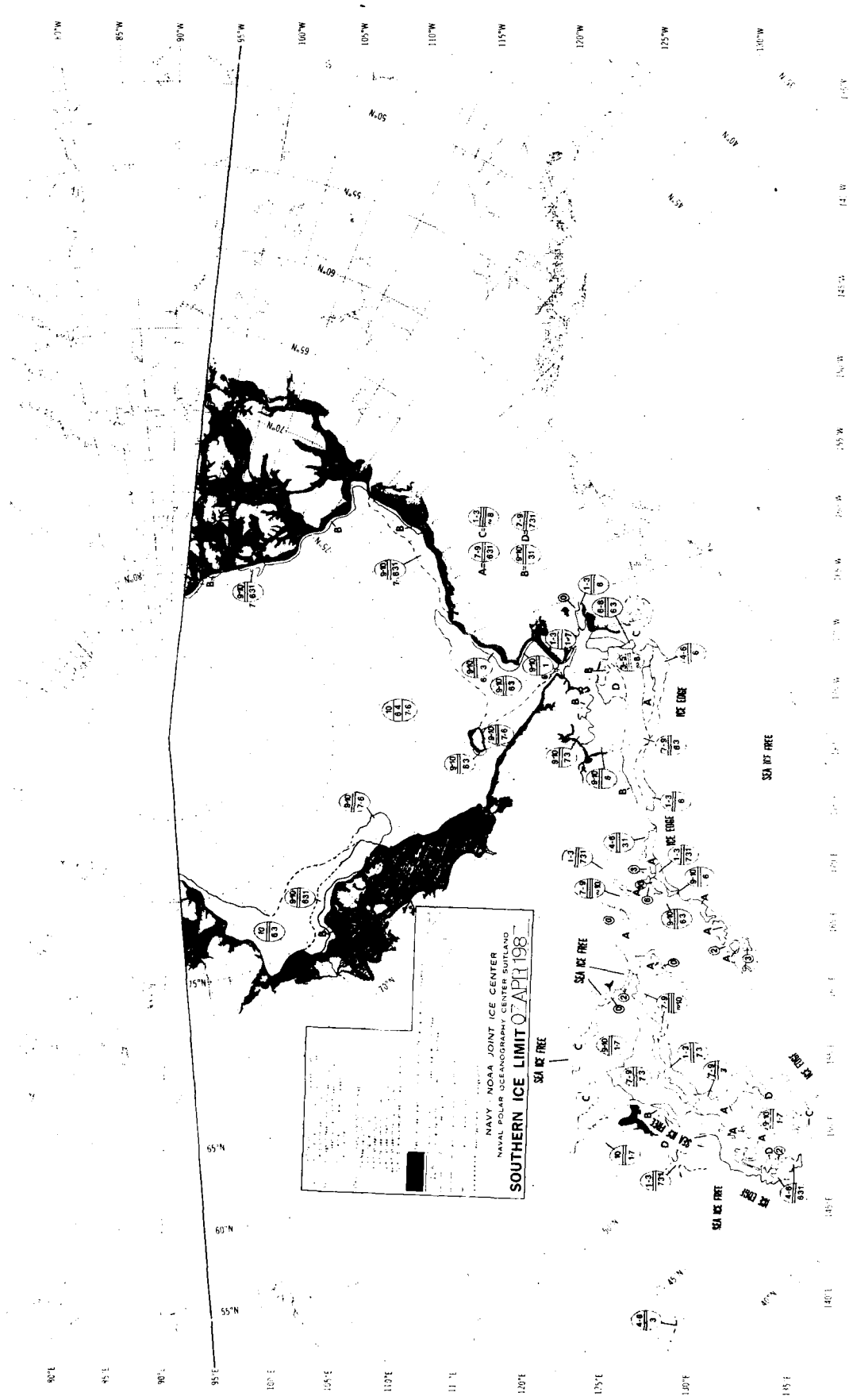


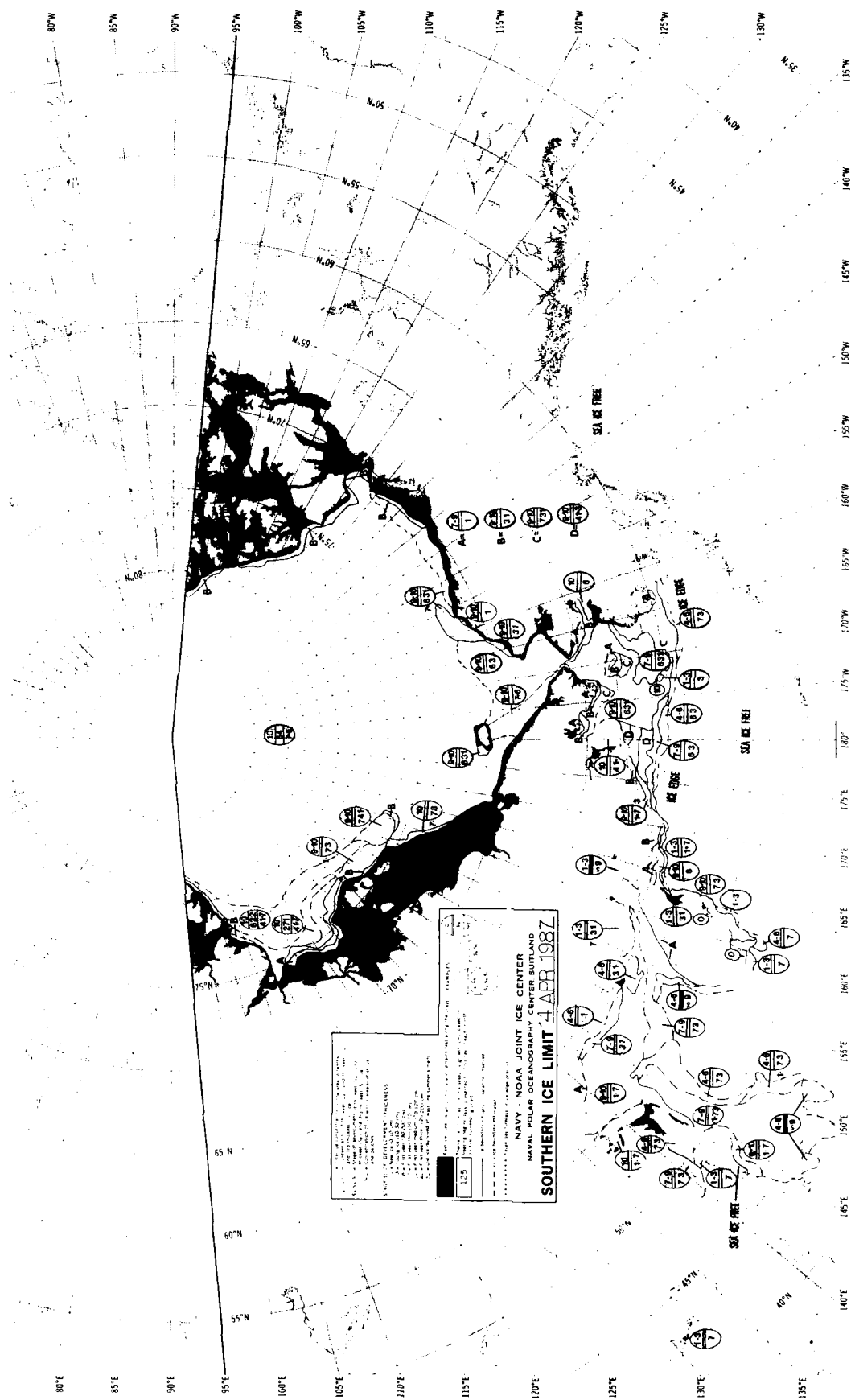


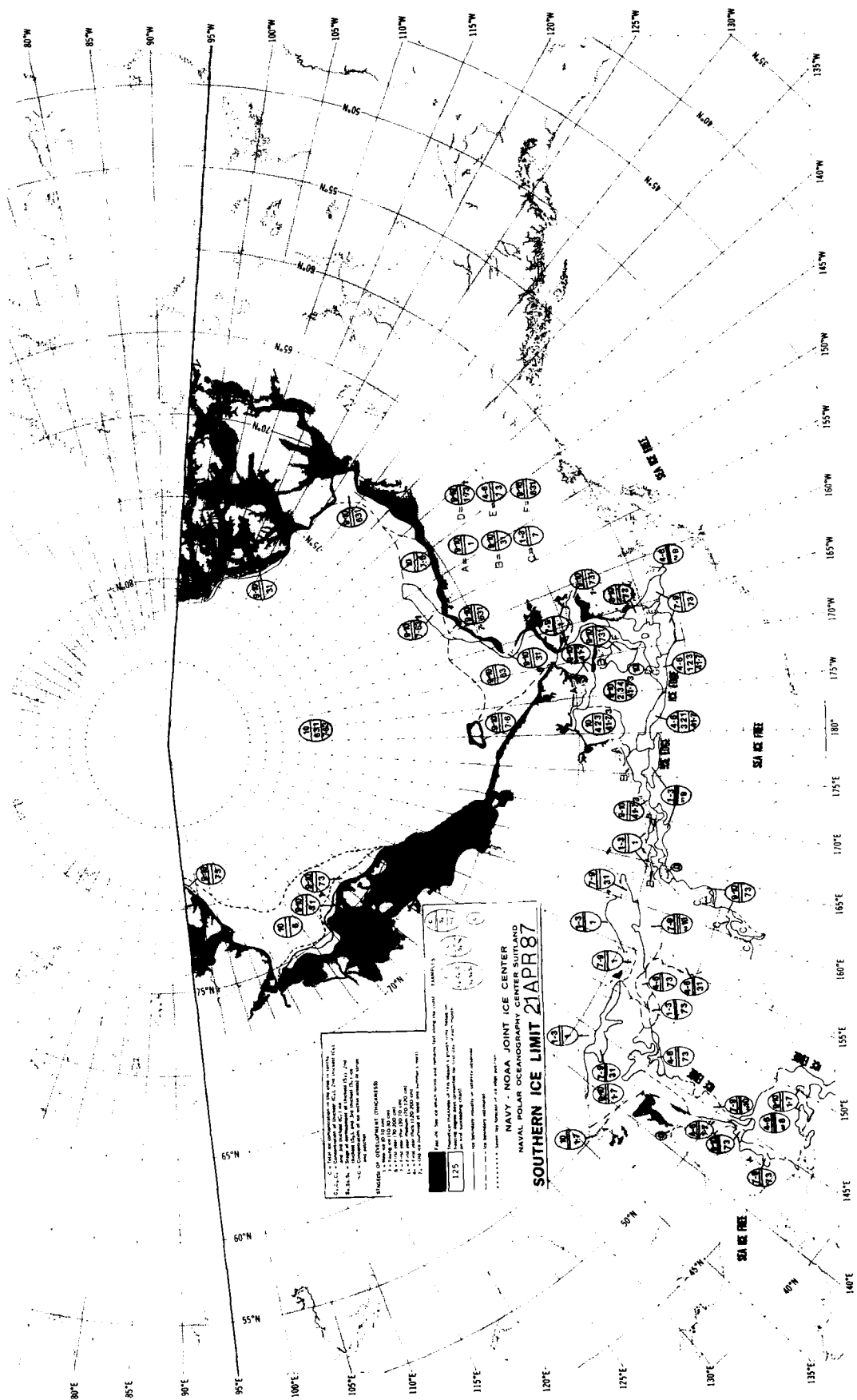


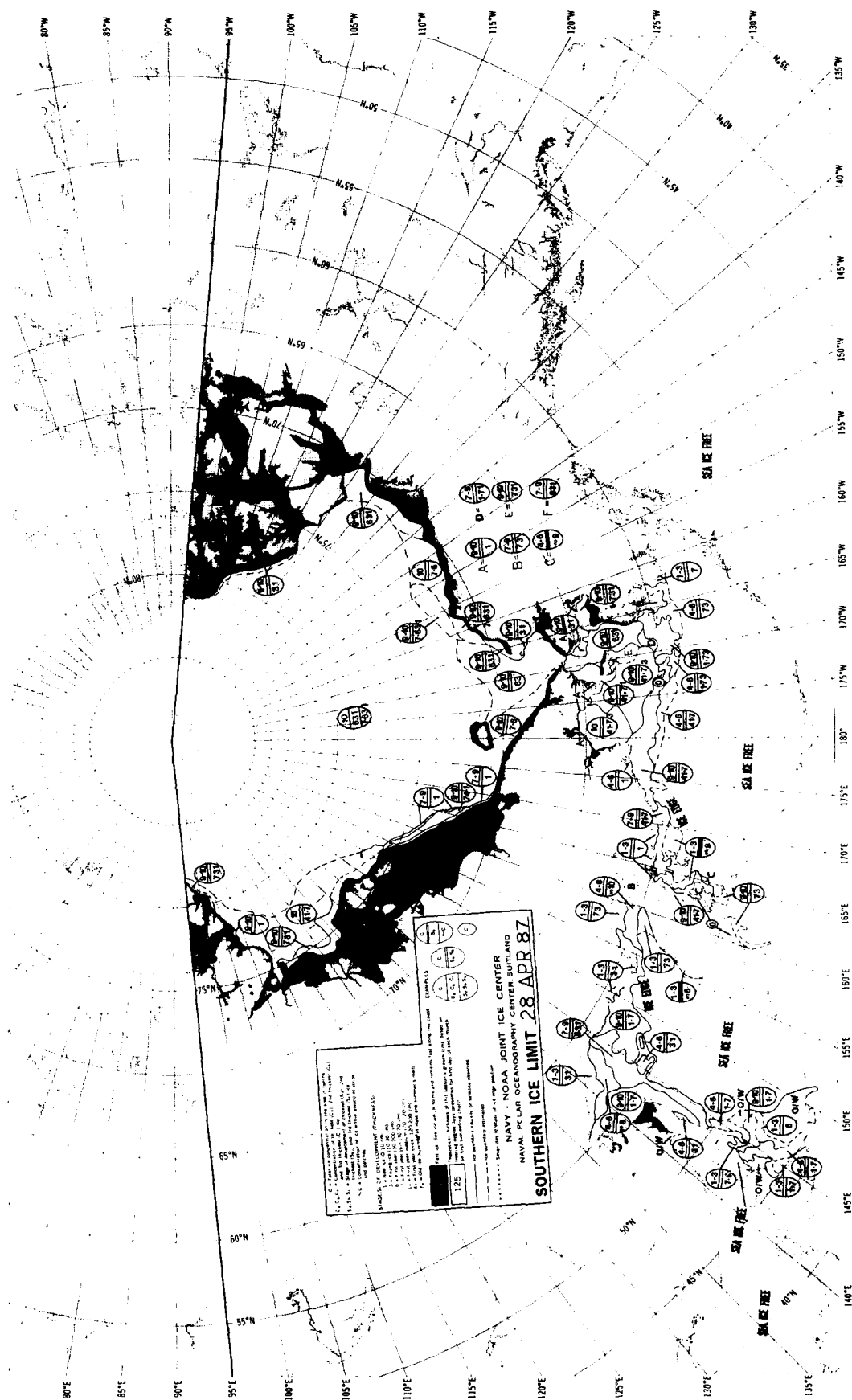


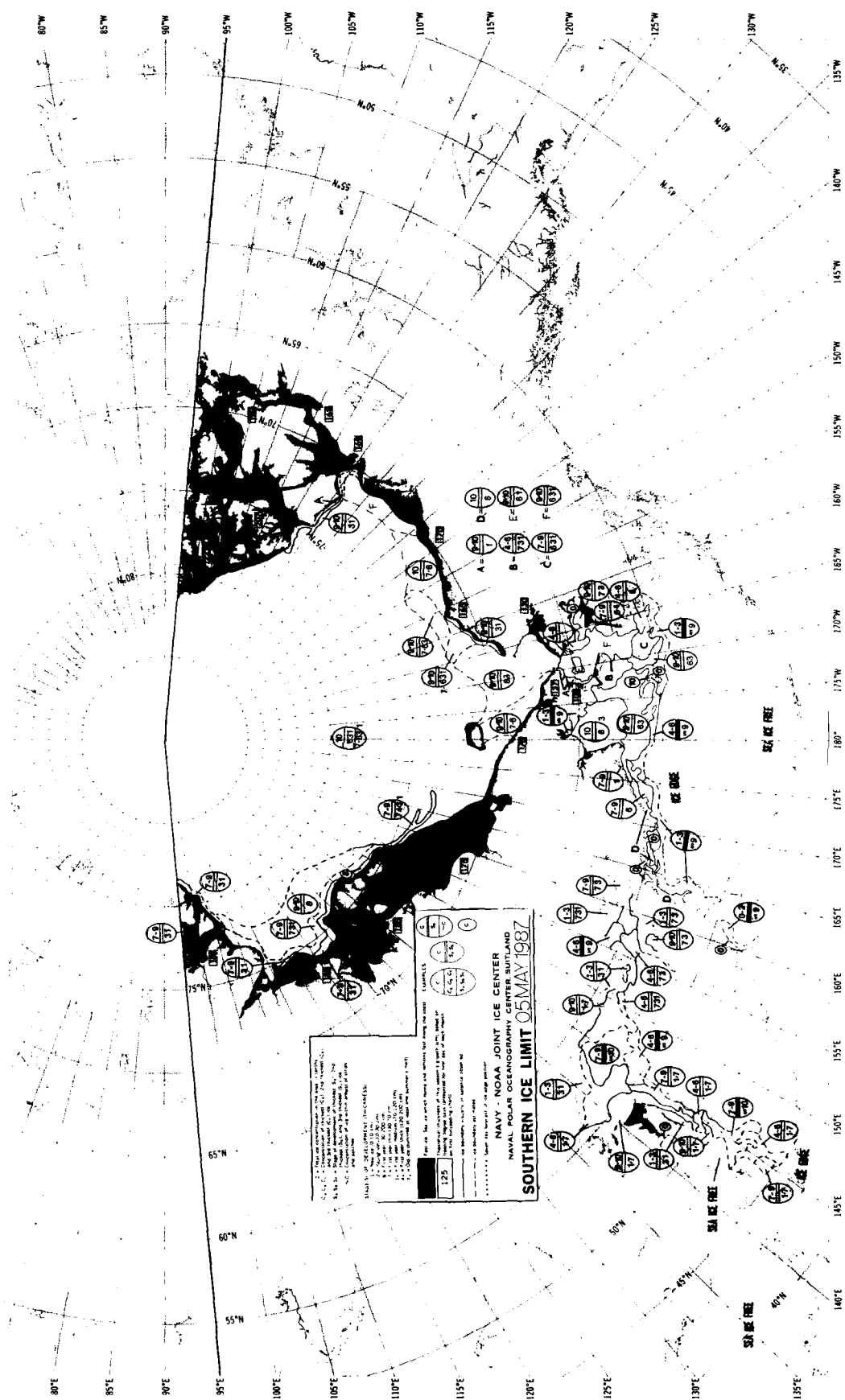












NAVY, NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUTLAND
SOUTHERN ICE LIMIT 05 MAY 1987

LEGEND

125

100

75

50

25

0

1000

2000

3000

4000

5000

6000

7000

8000

9000

10000

11000

12000

13000

14000

15000

16000

17000

18000

19000

20000

21000

22000

23000

24000

25000

26000

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95000

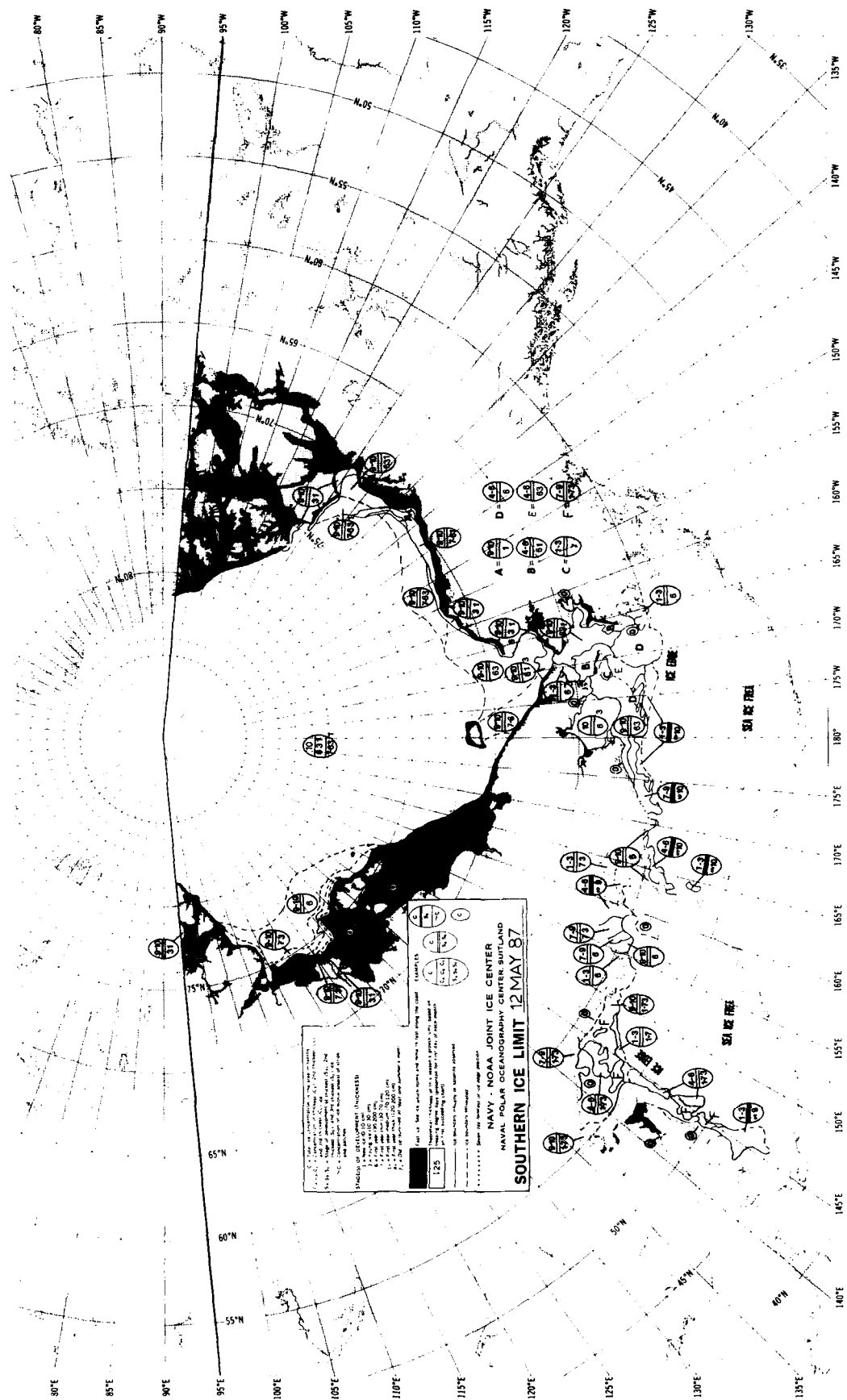
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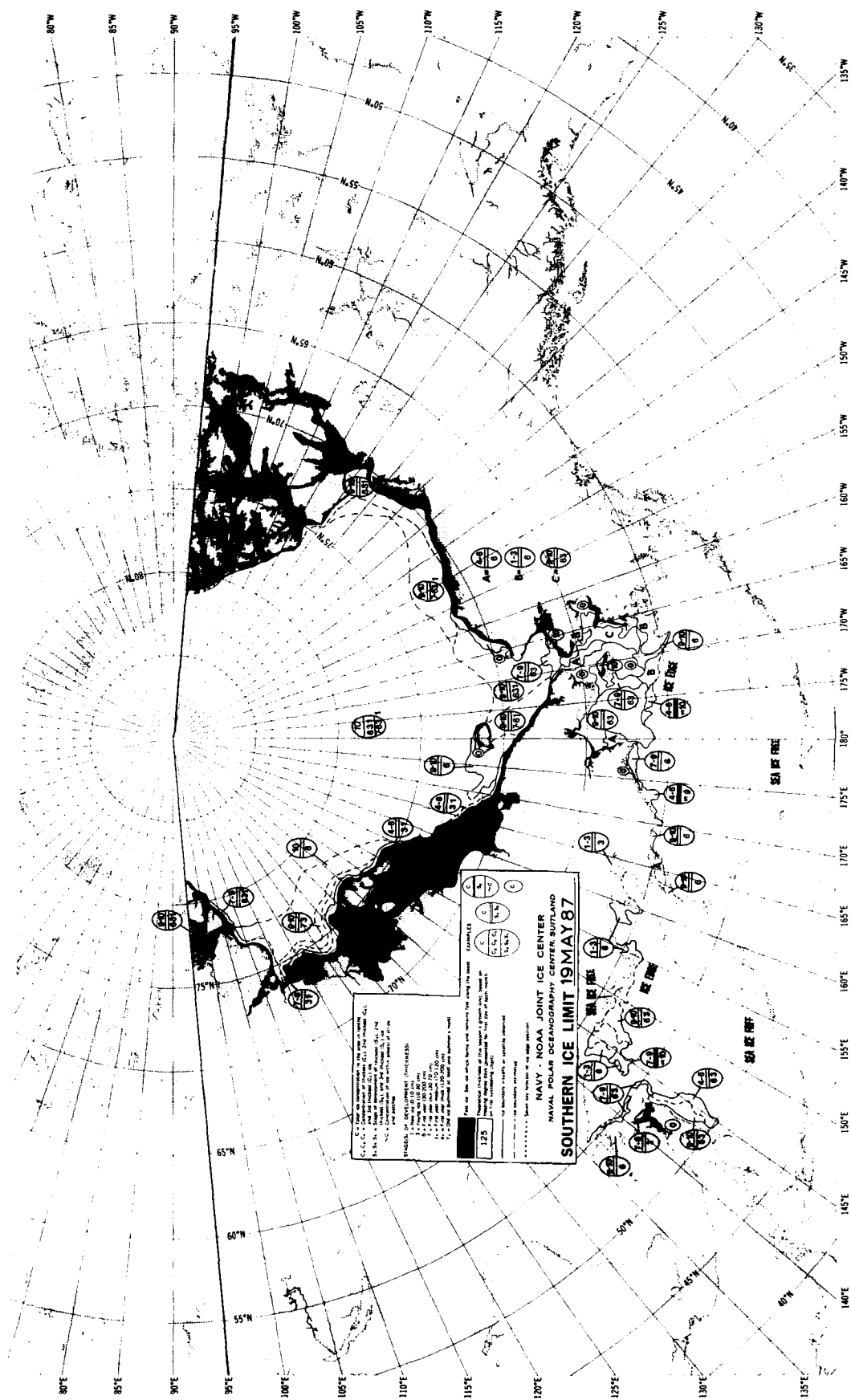
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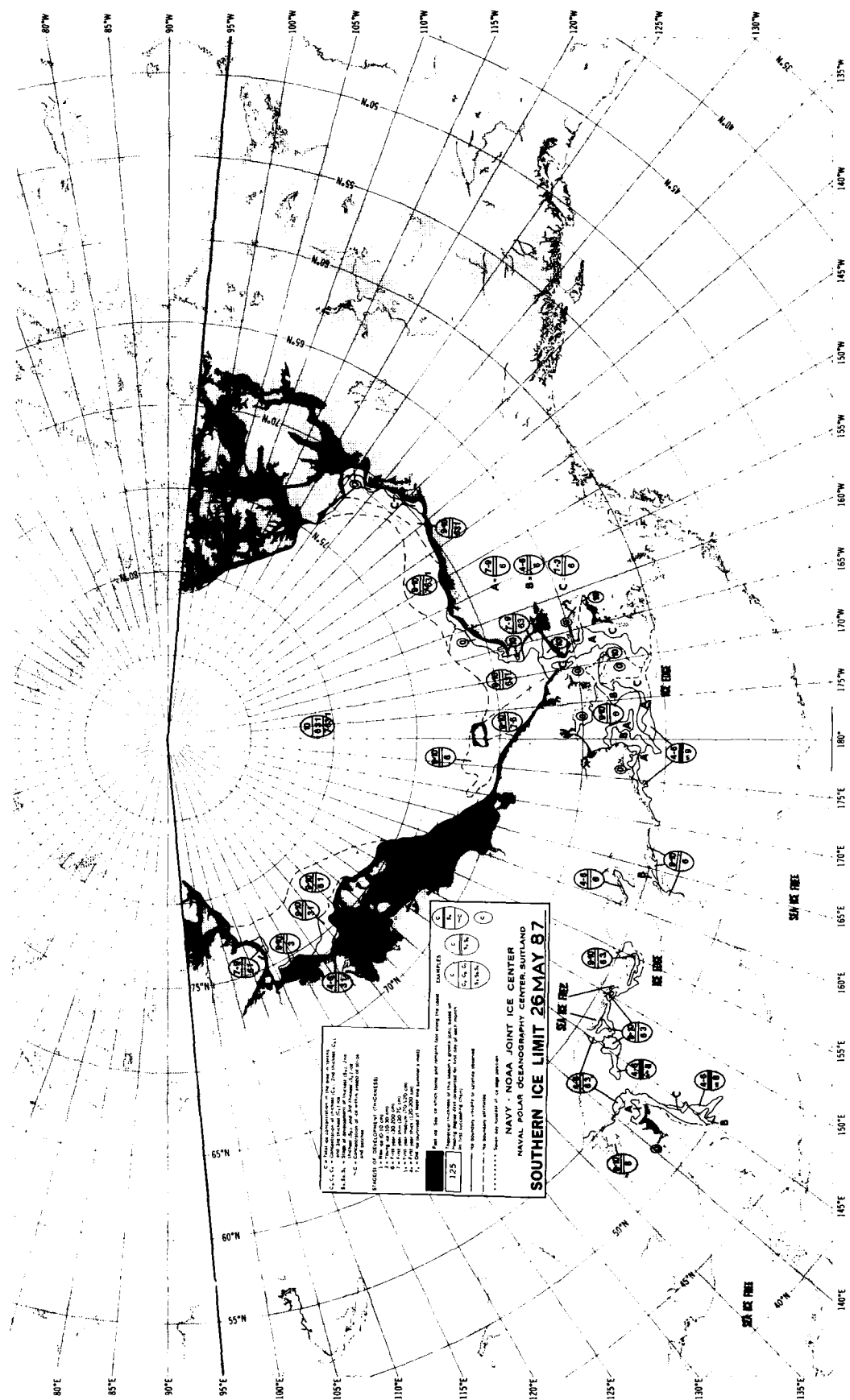
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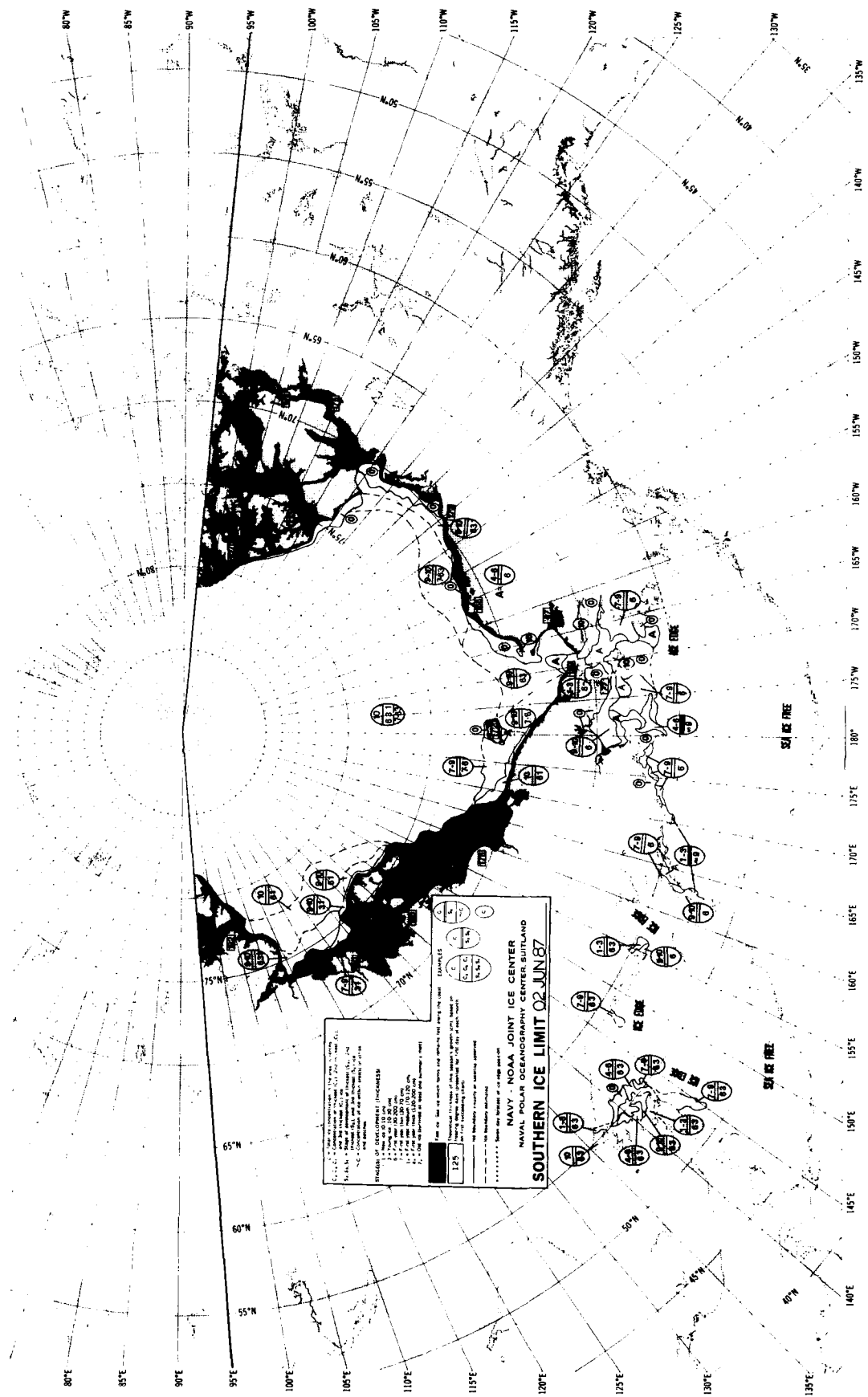
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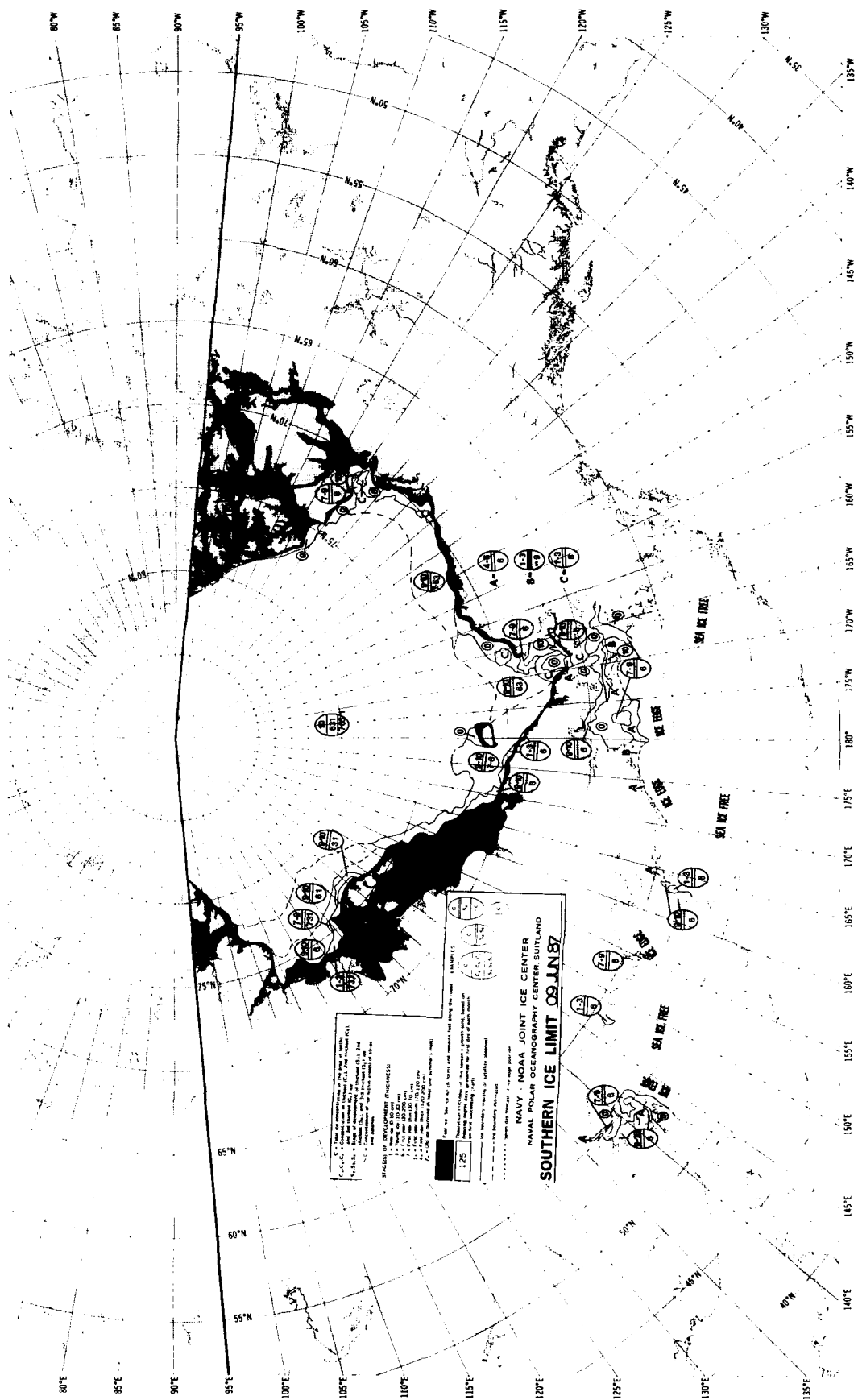
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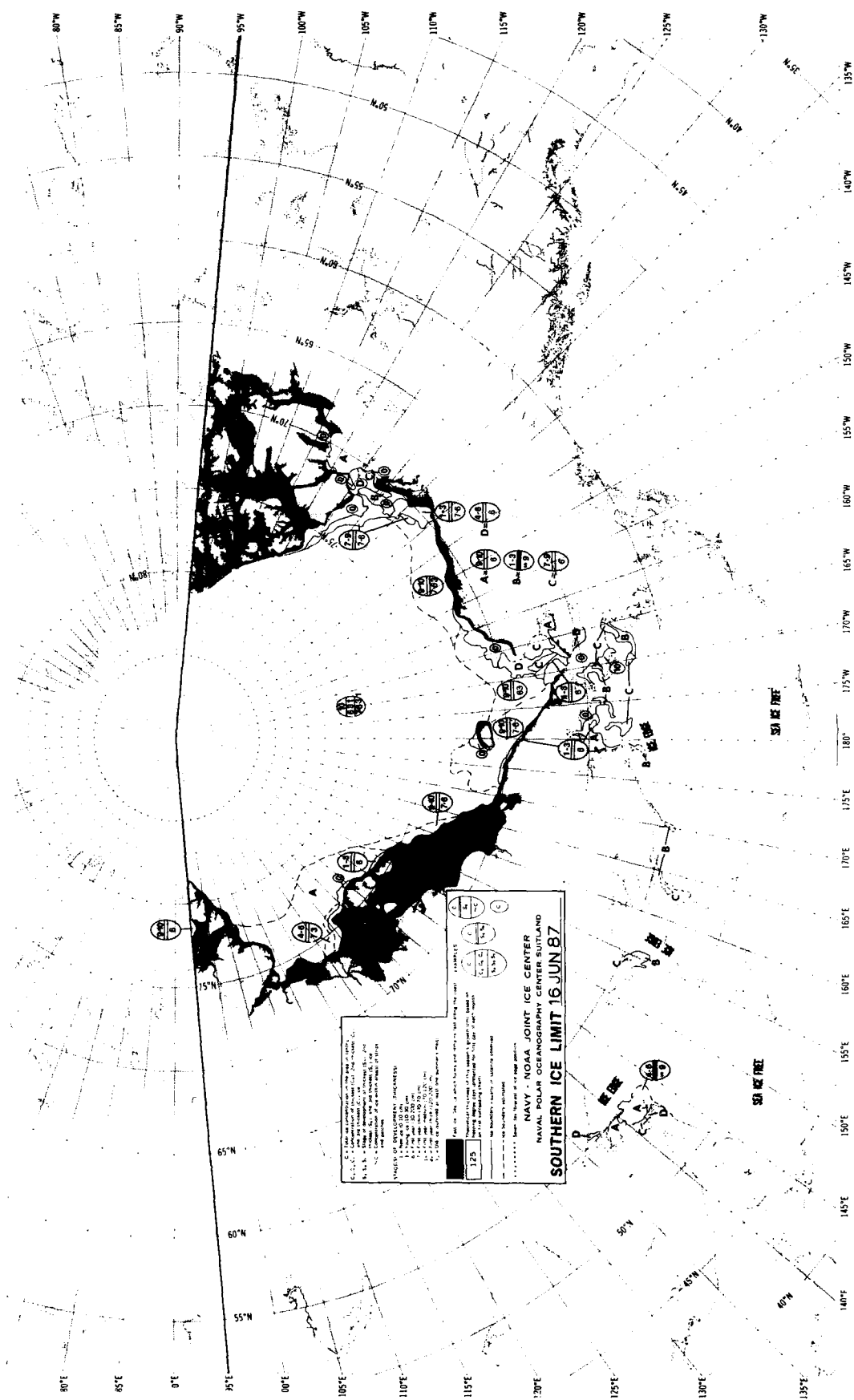


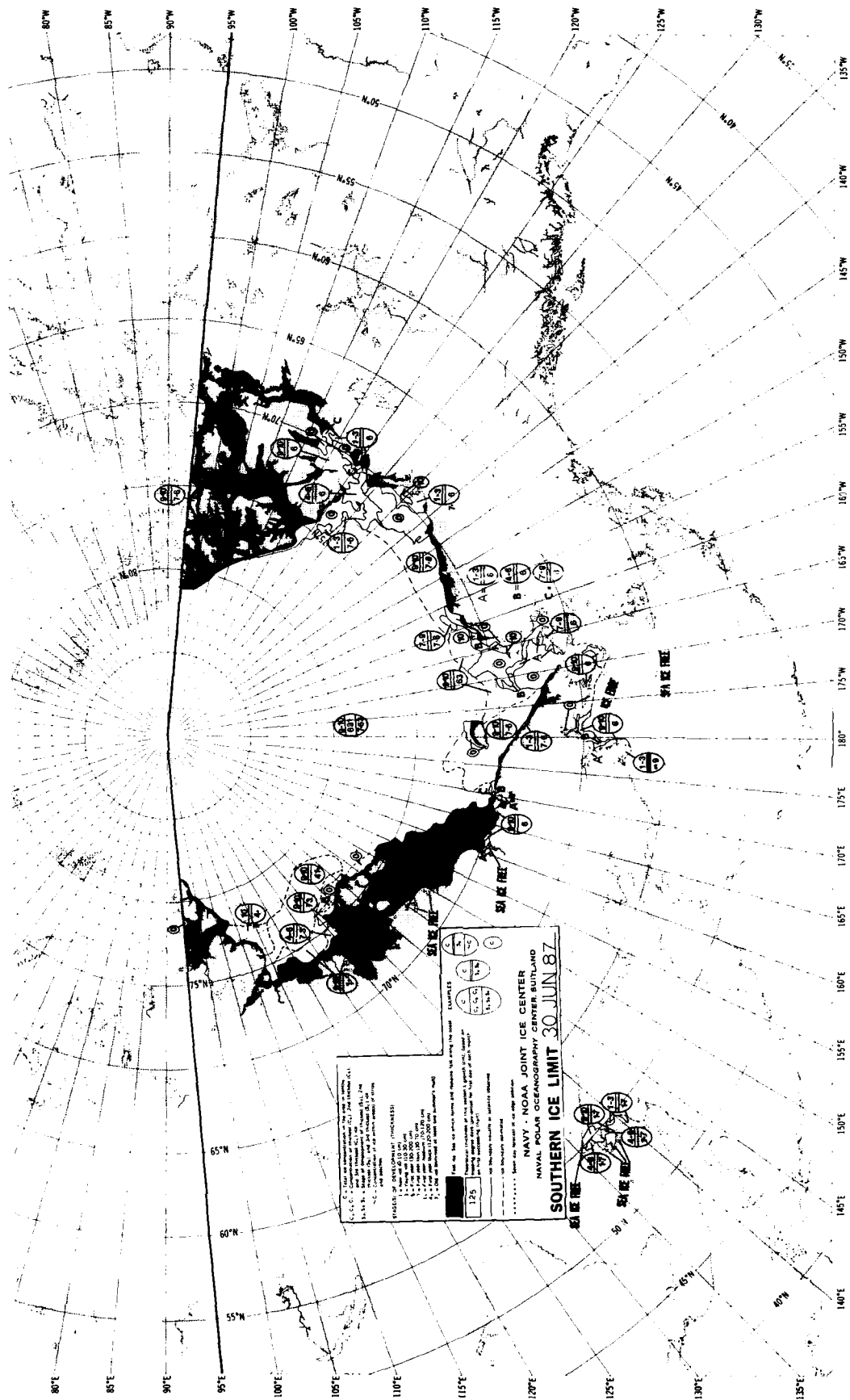


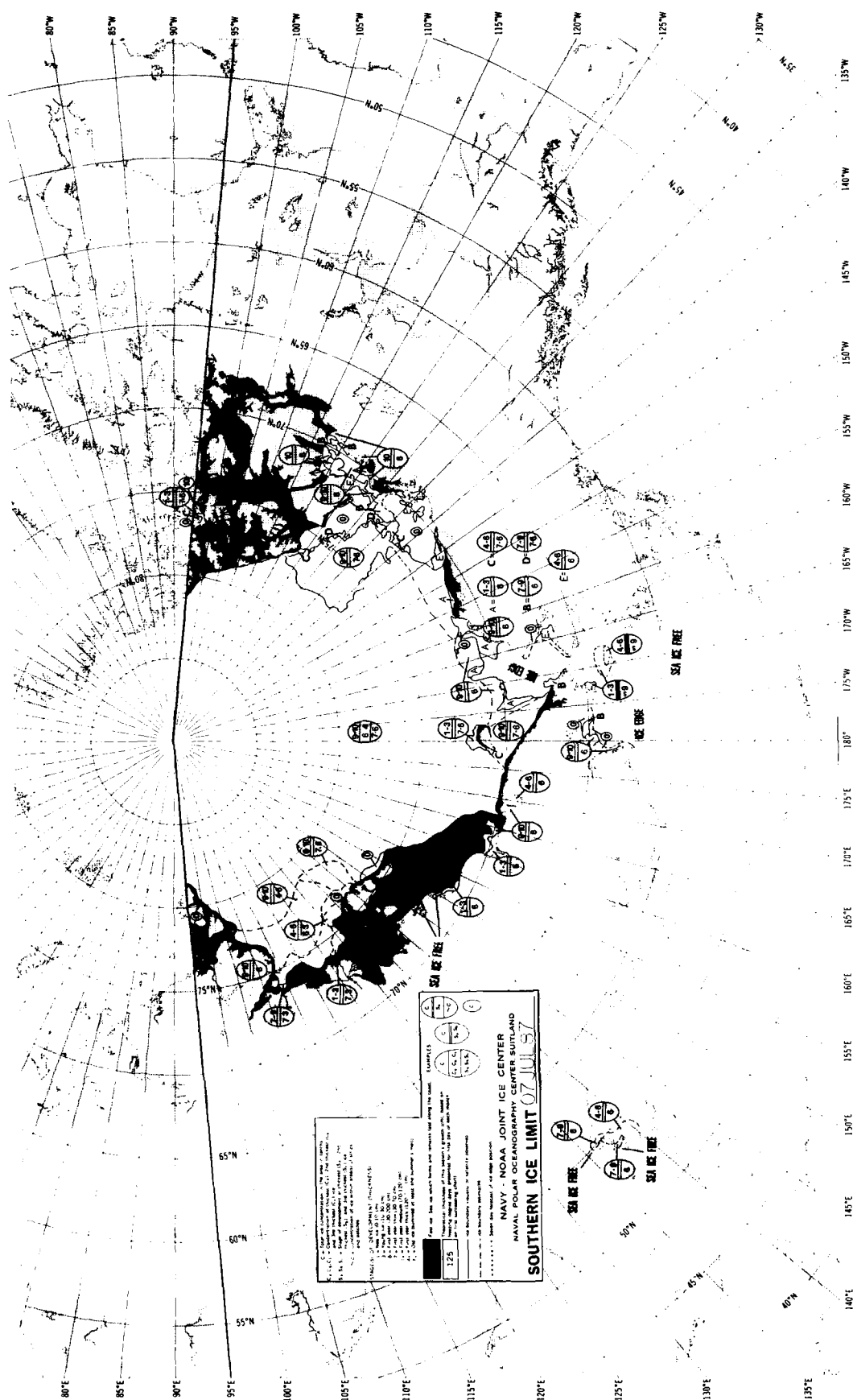


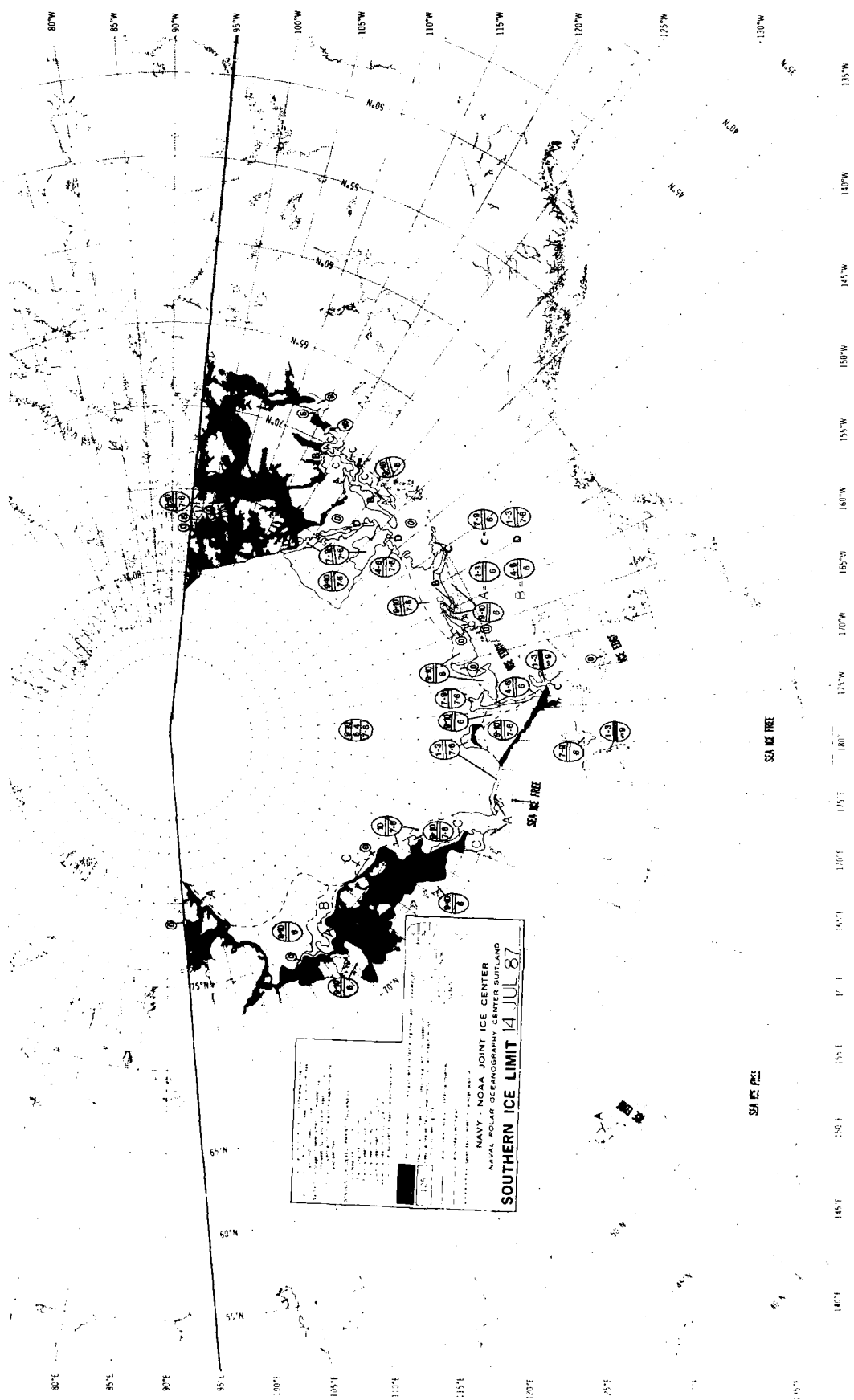


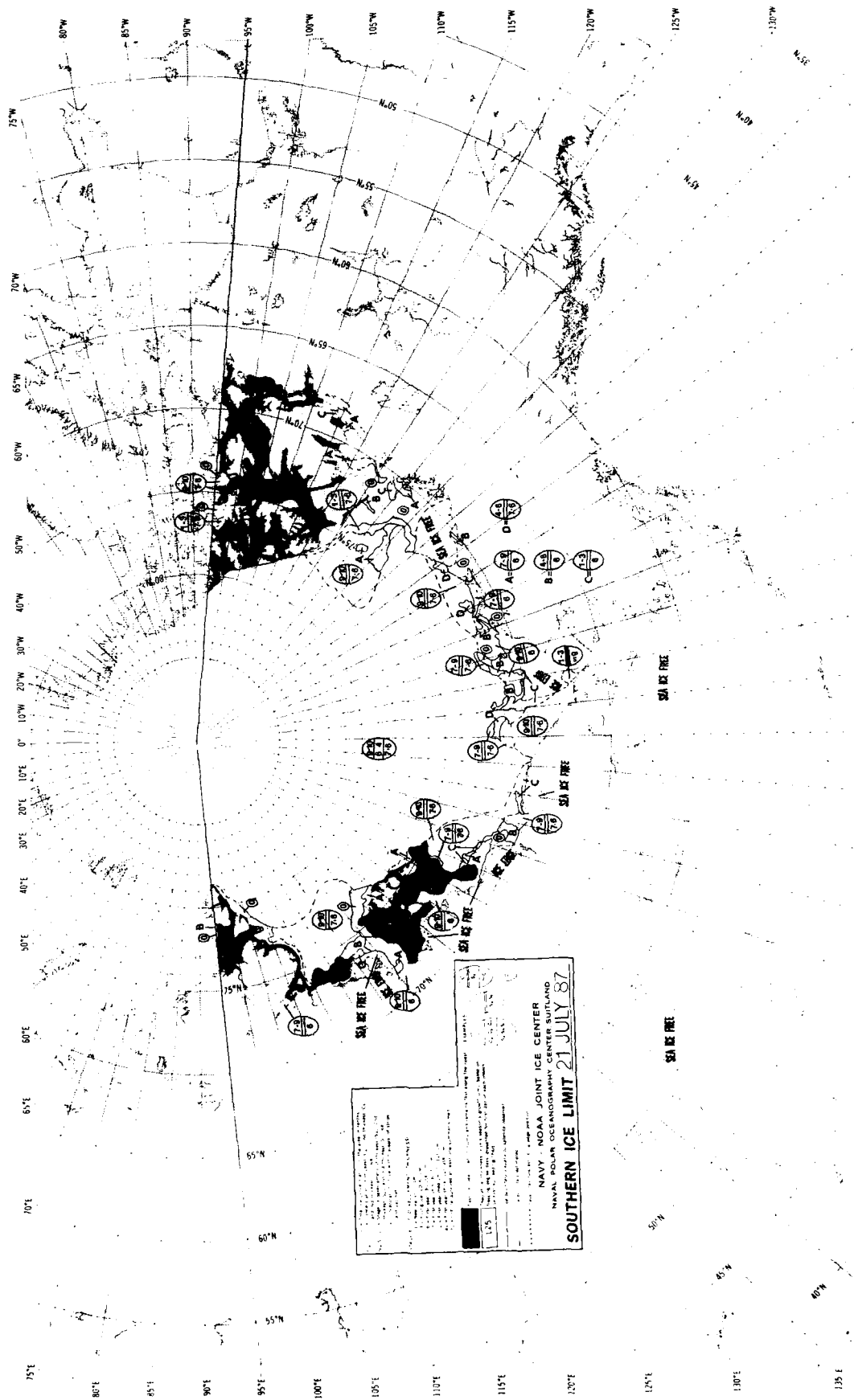


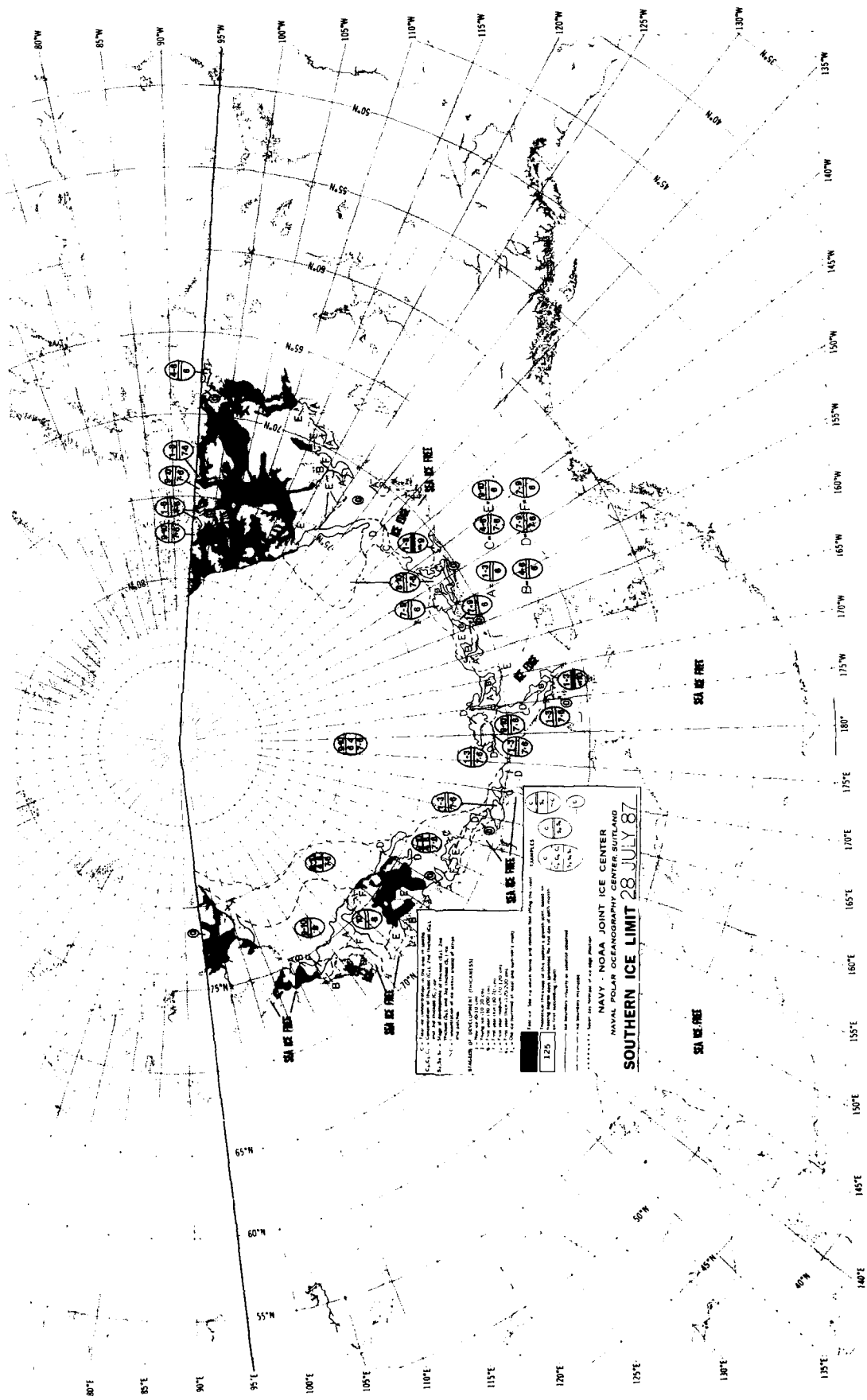


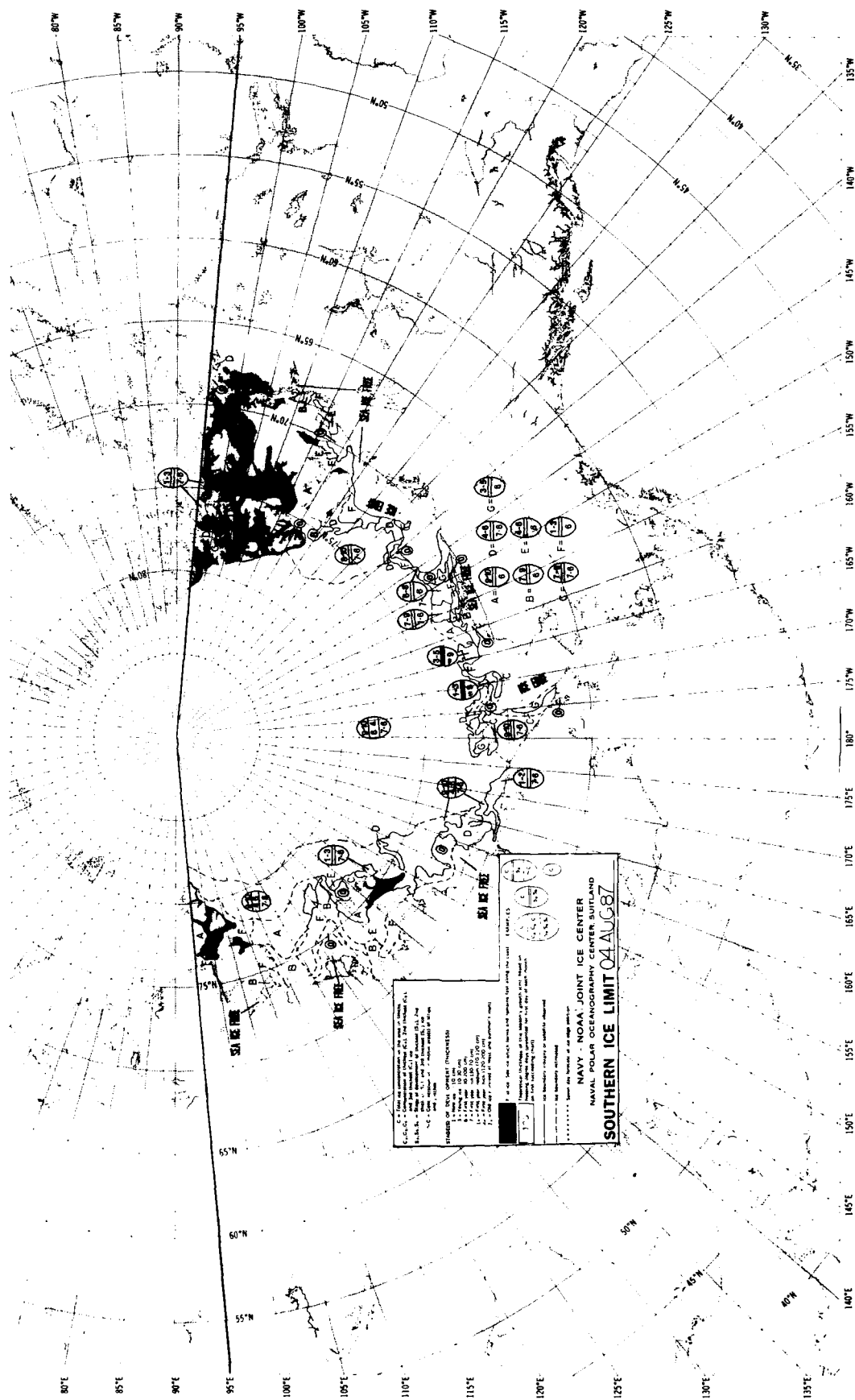


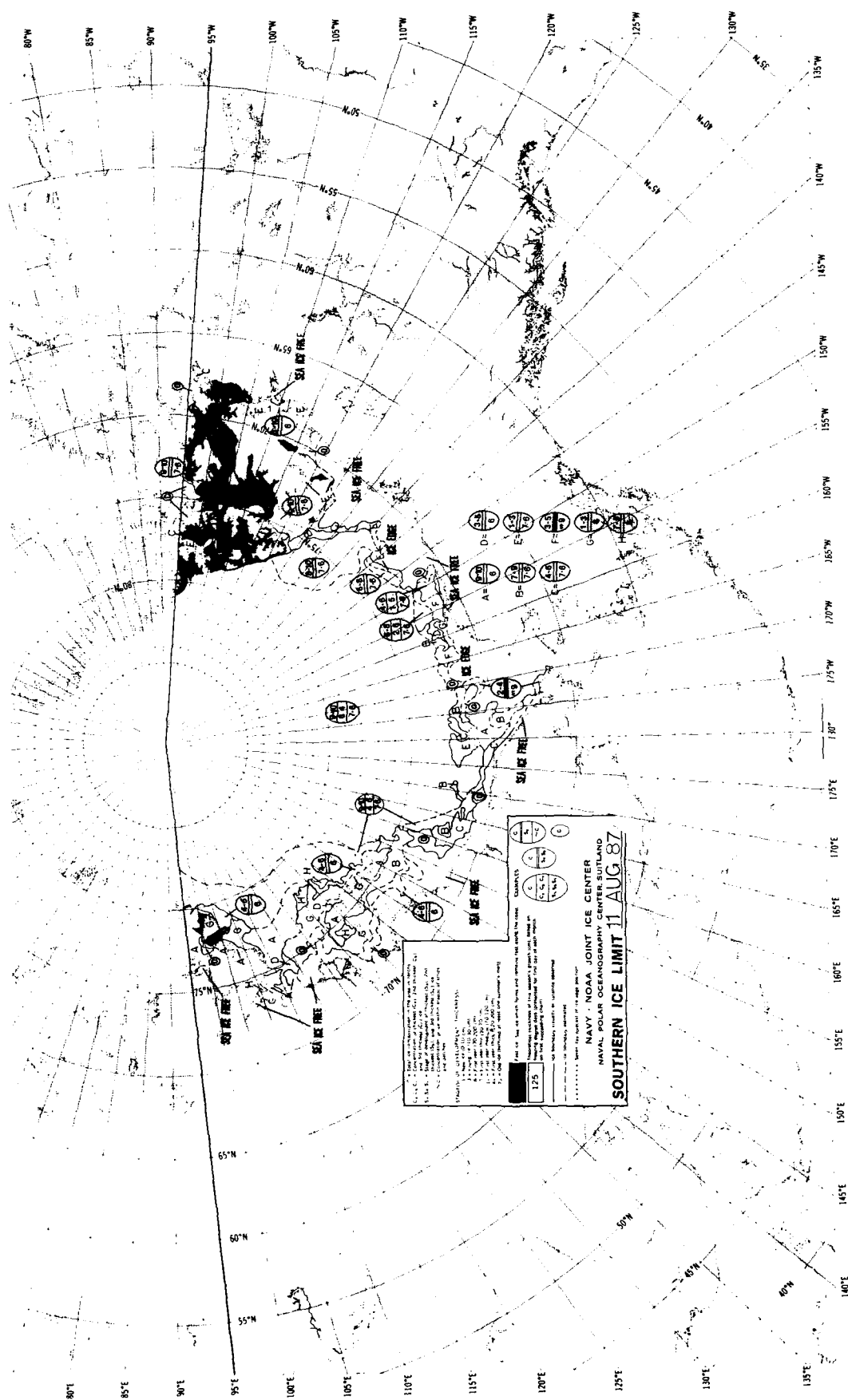


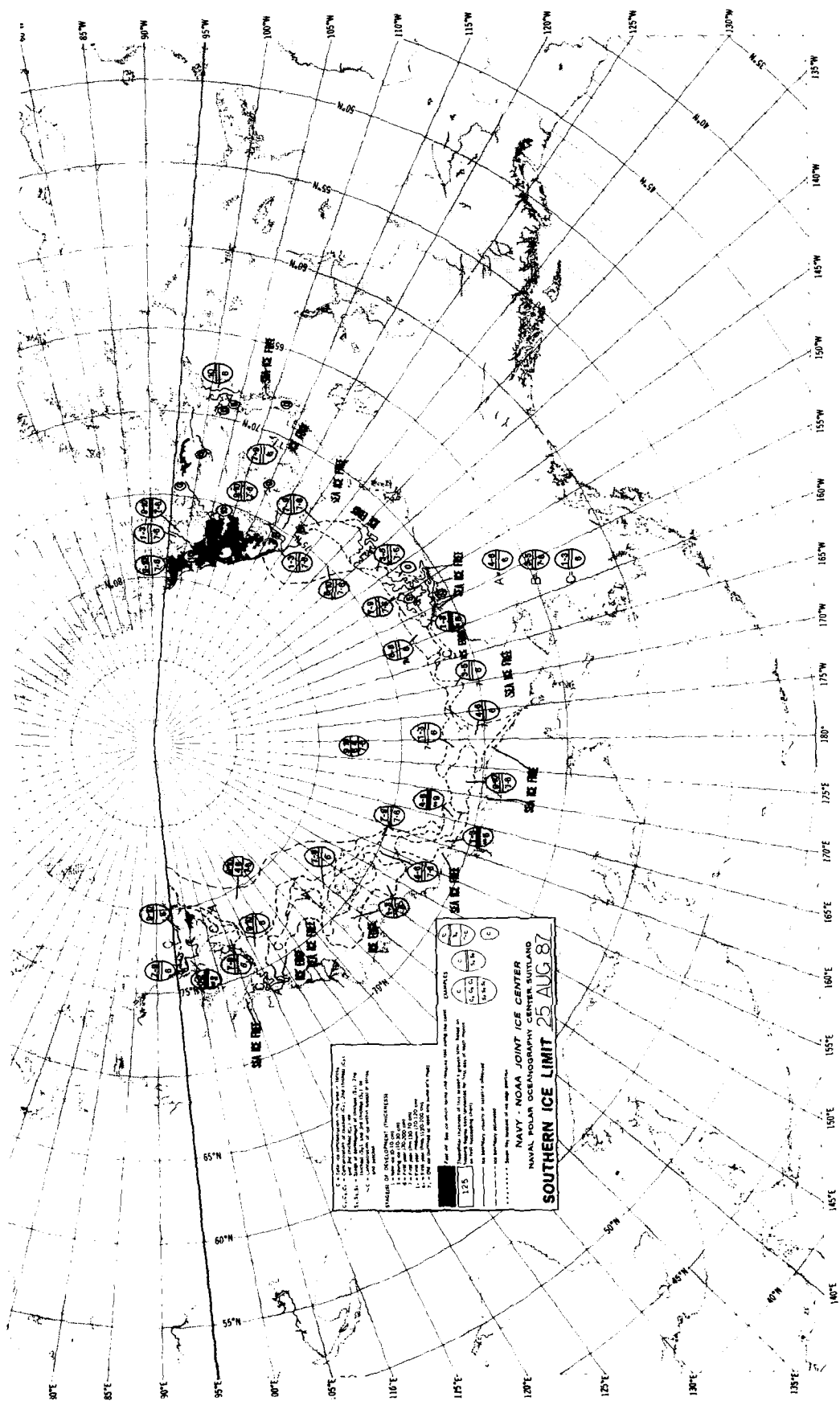


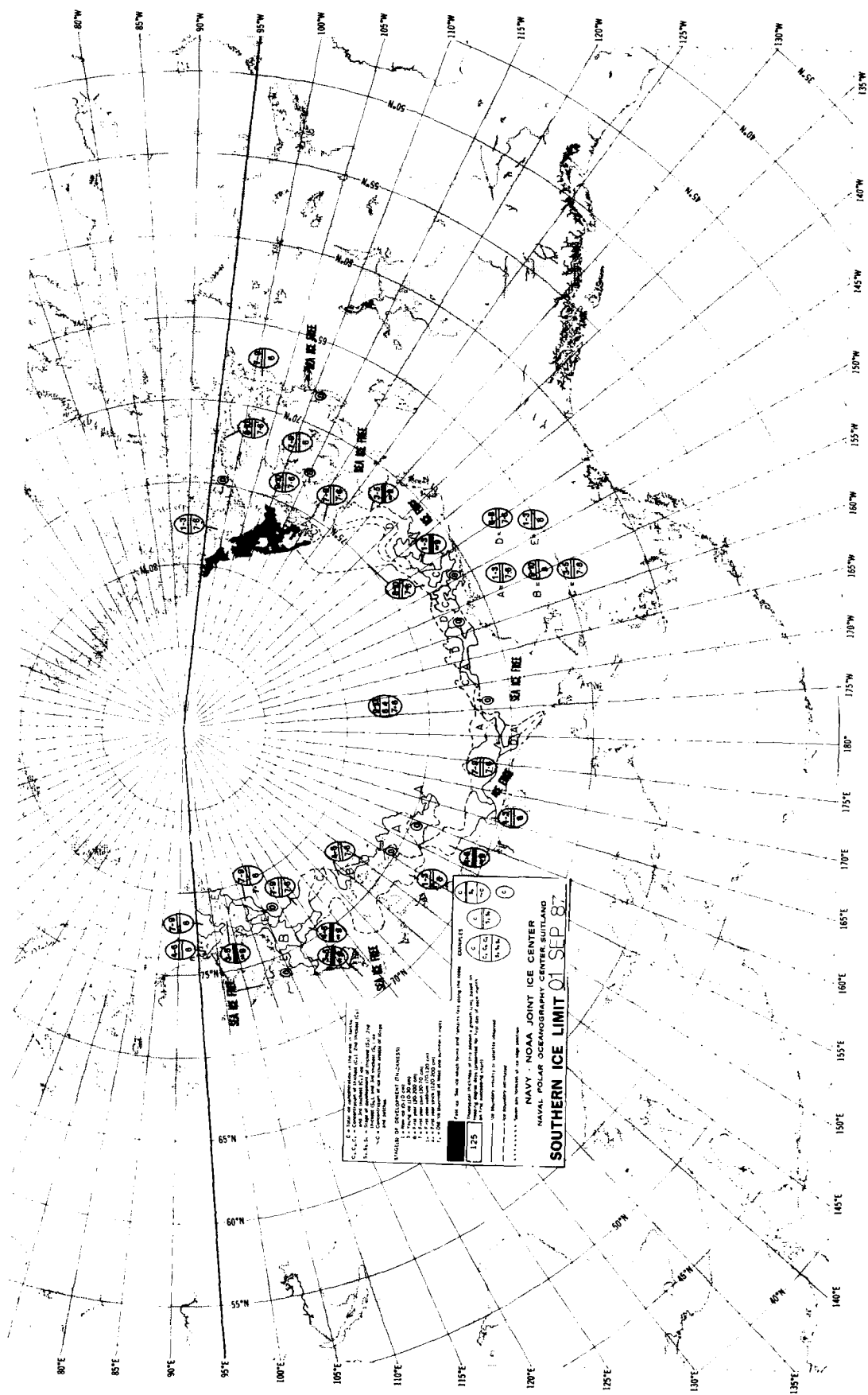


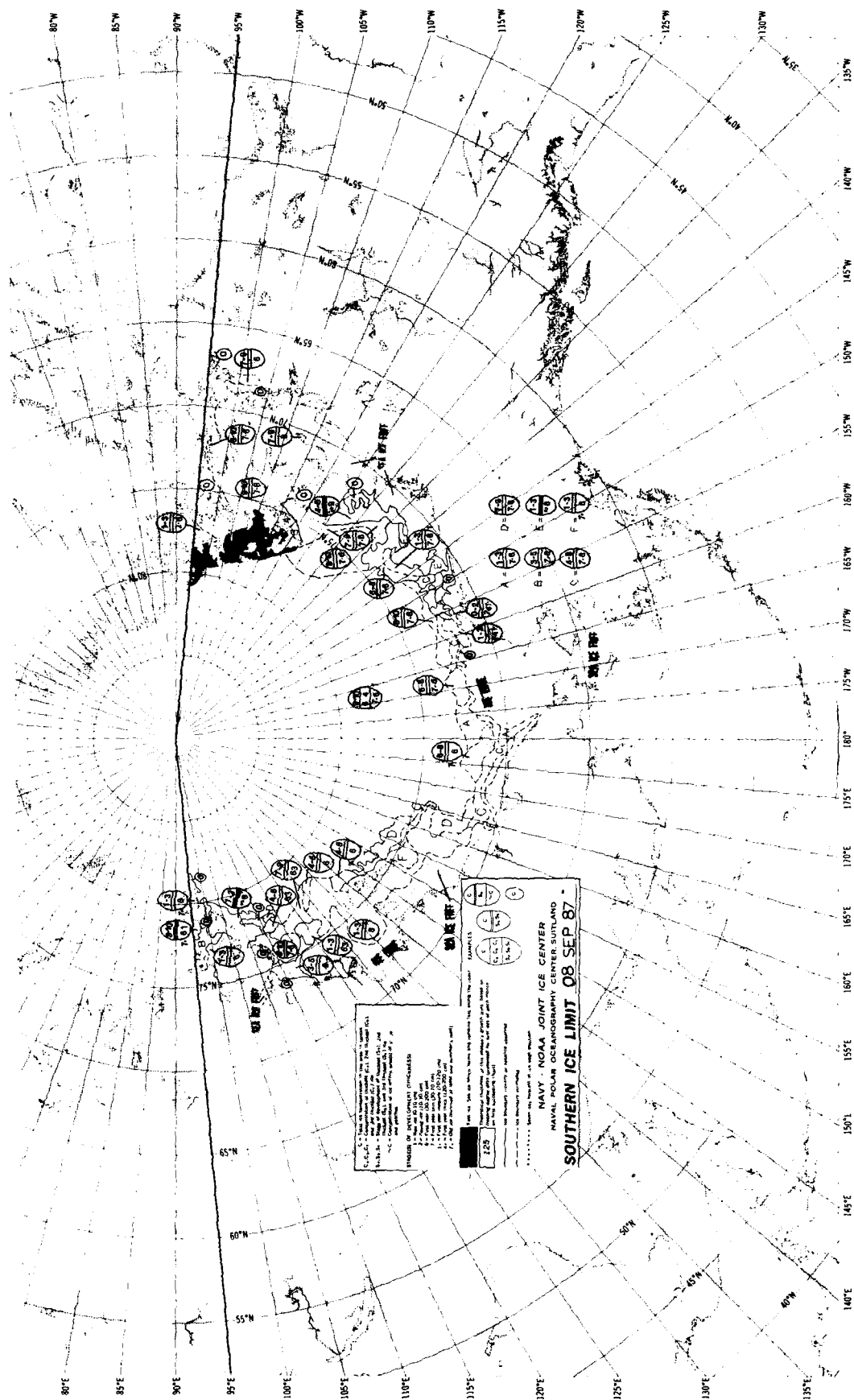


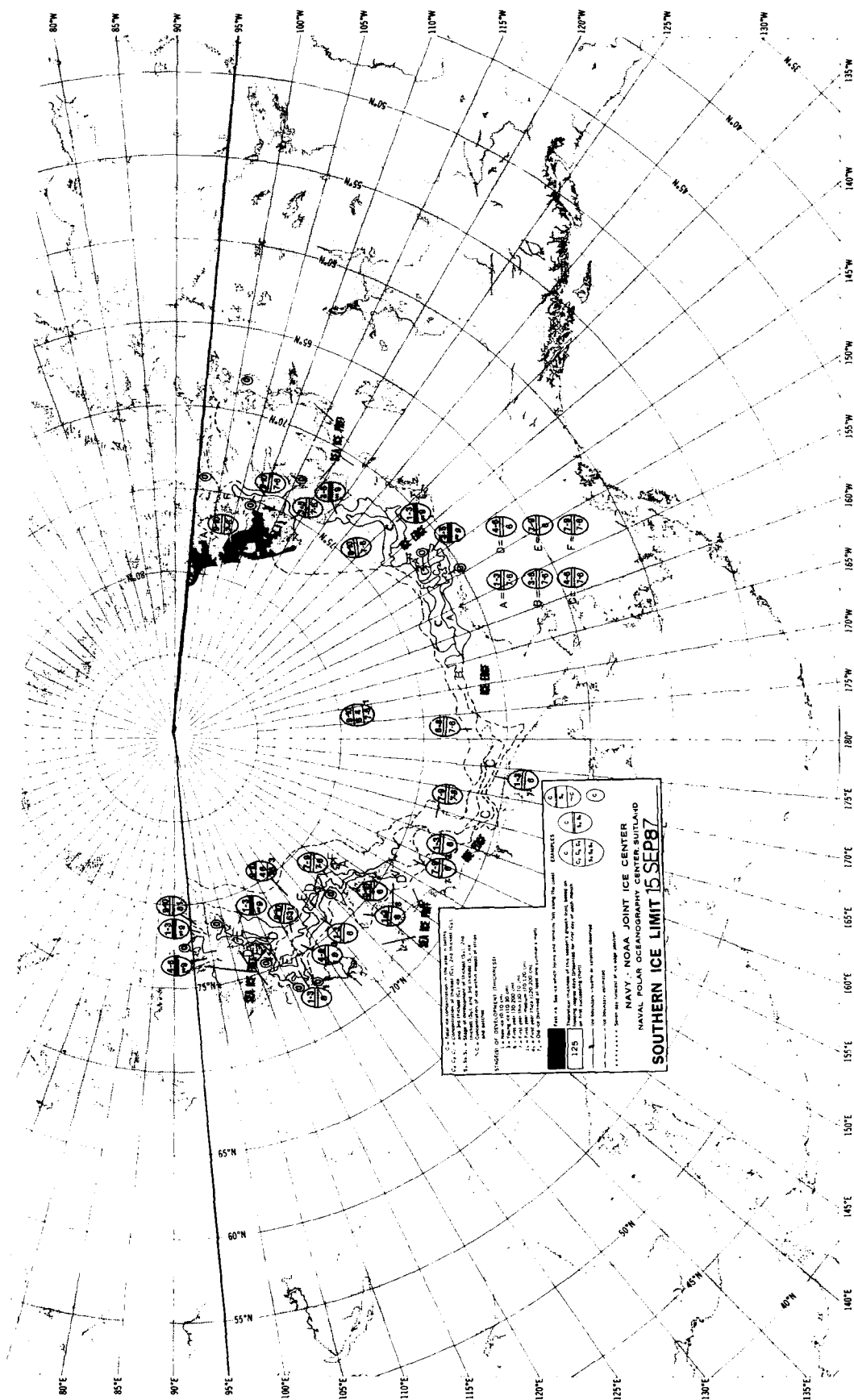


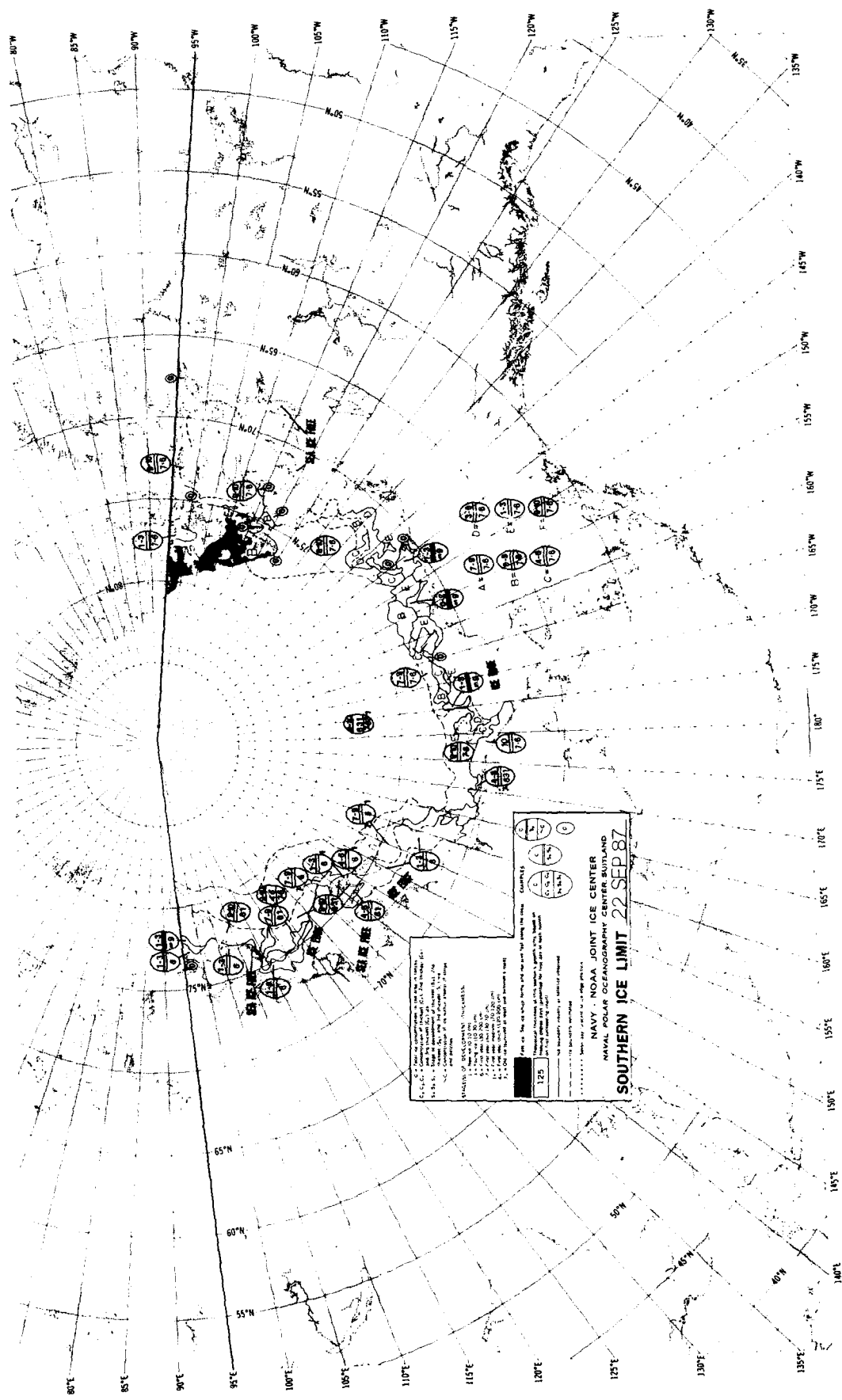




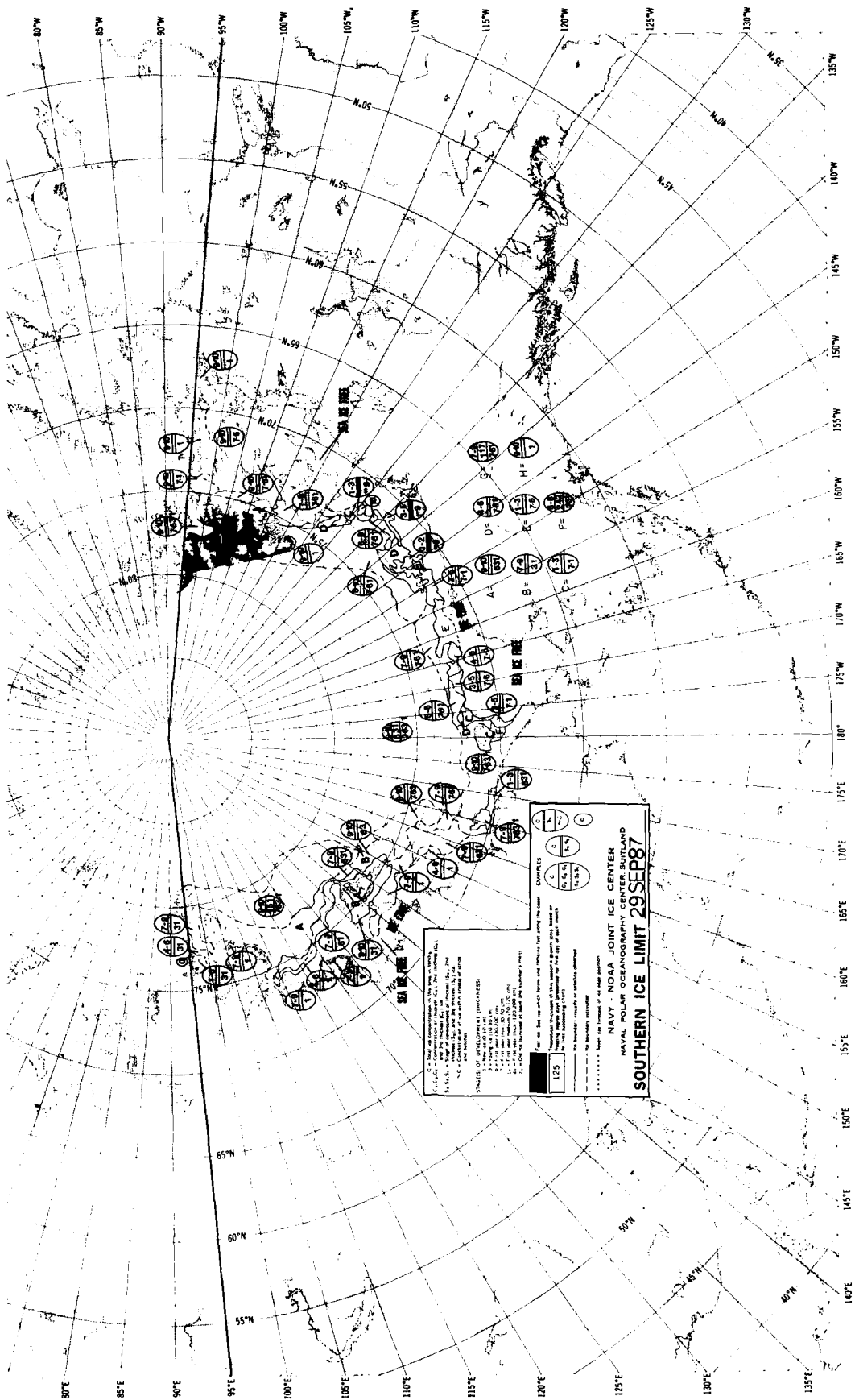


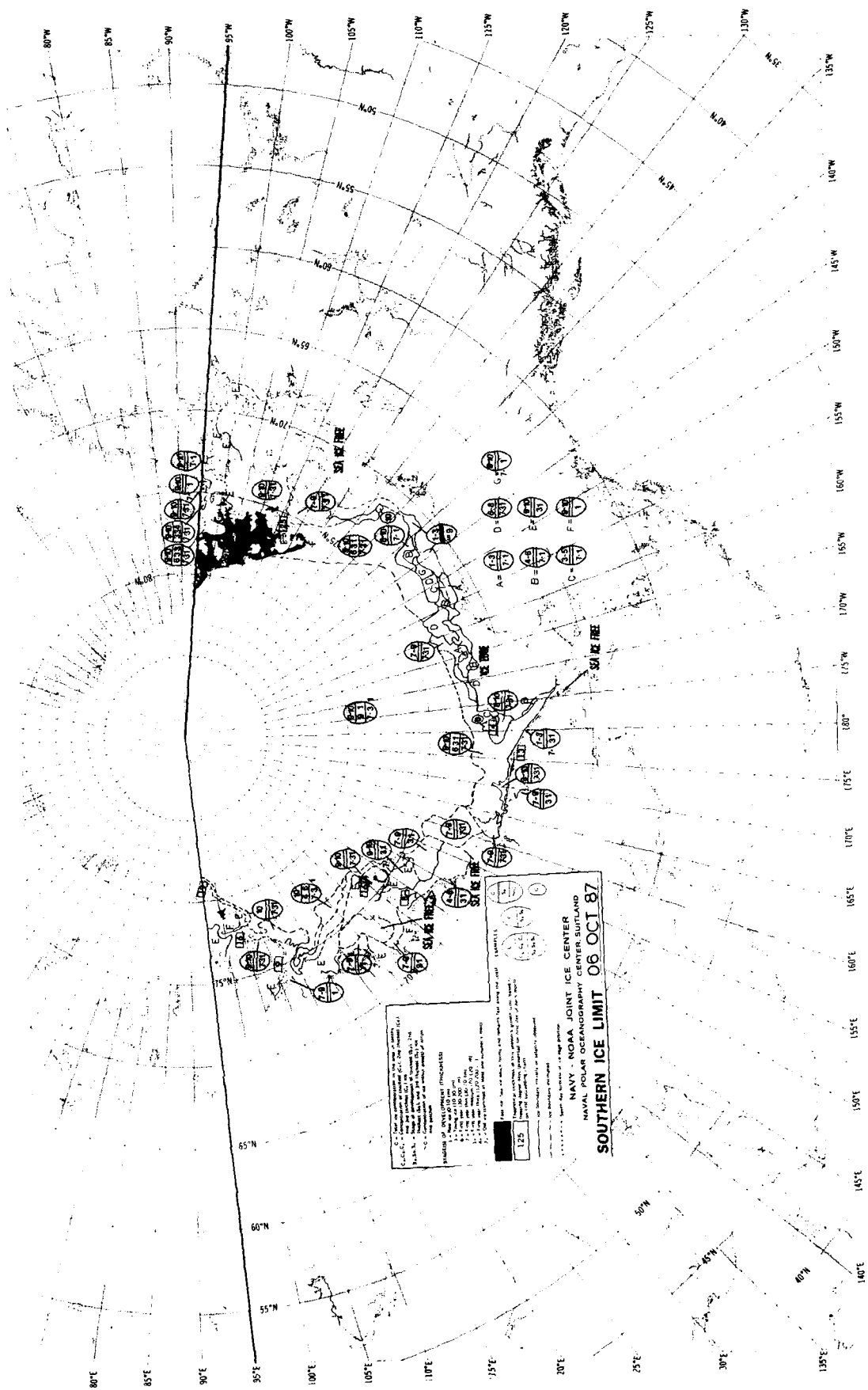


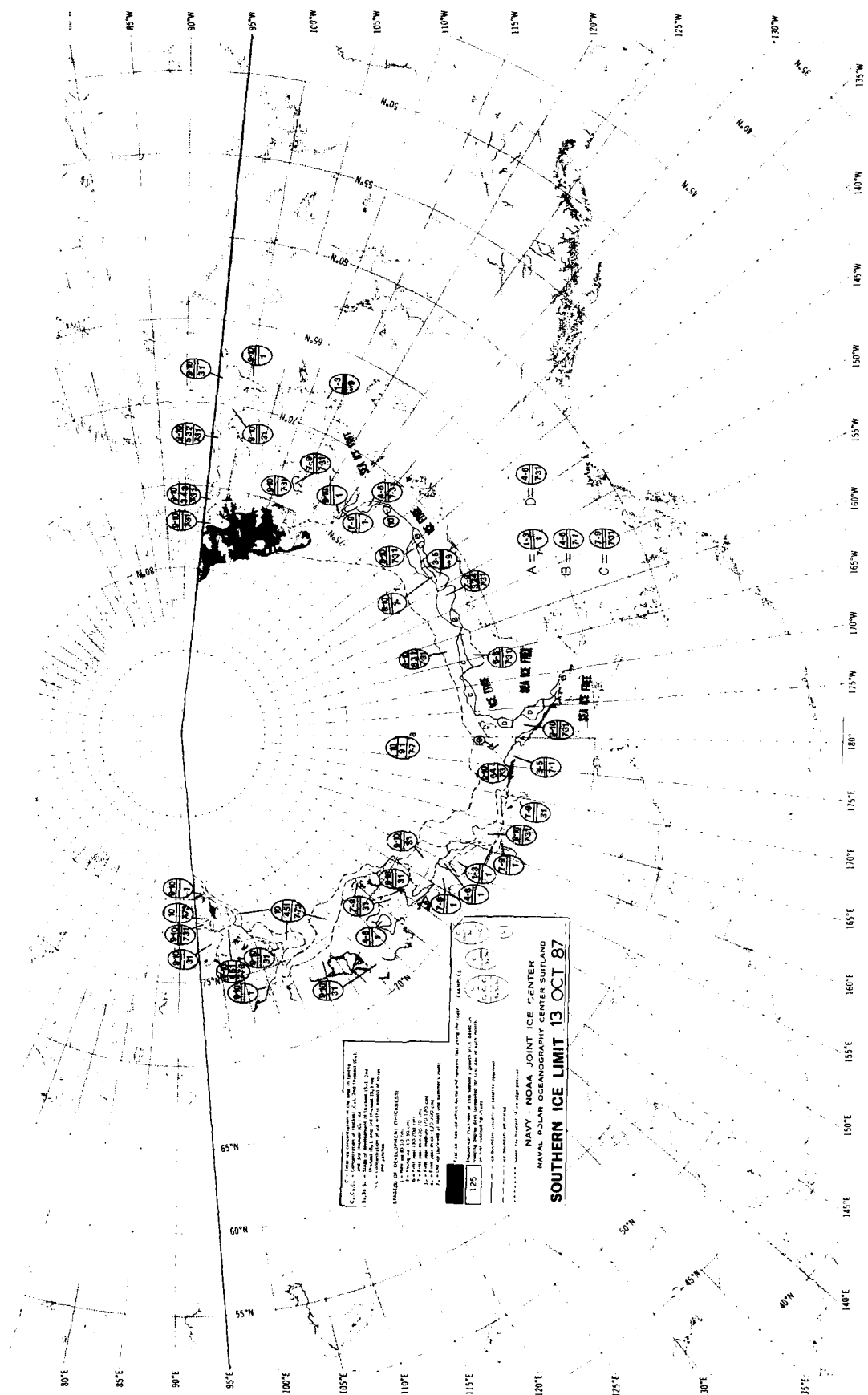


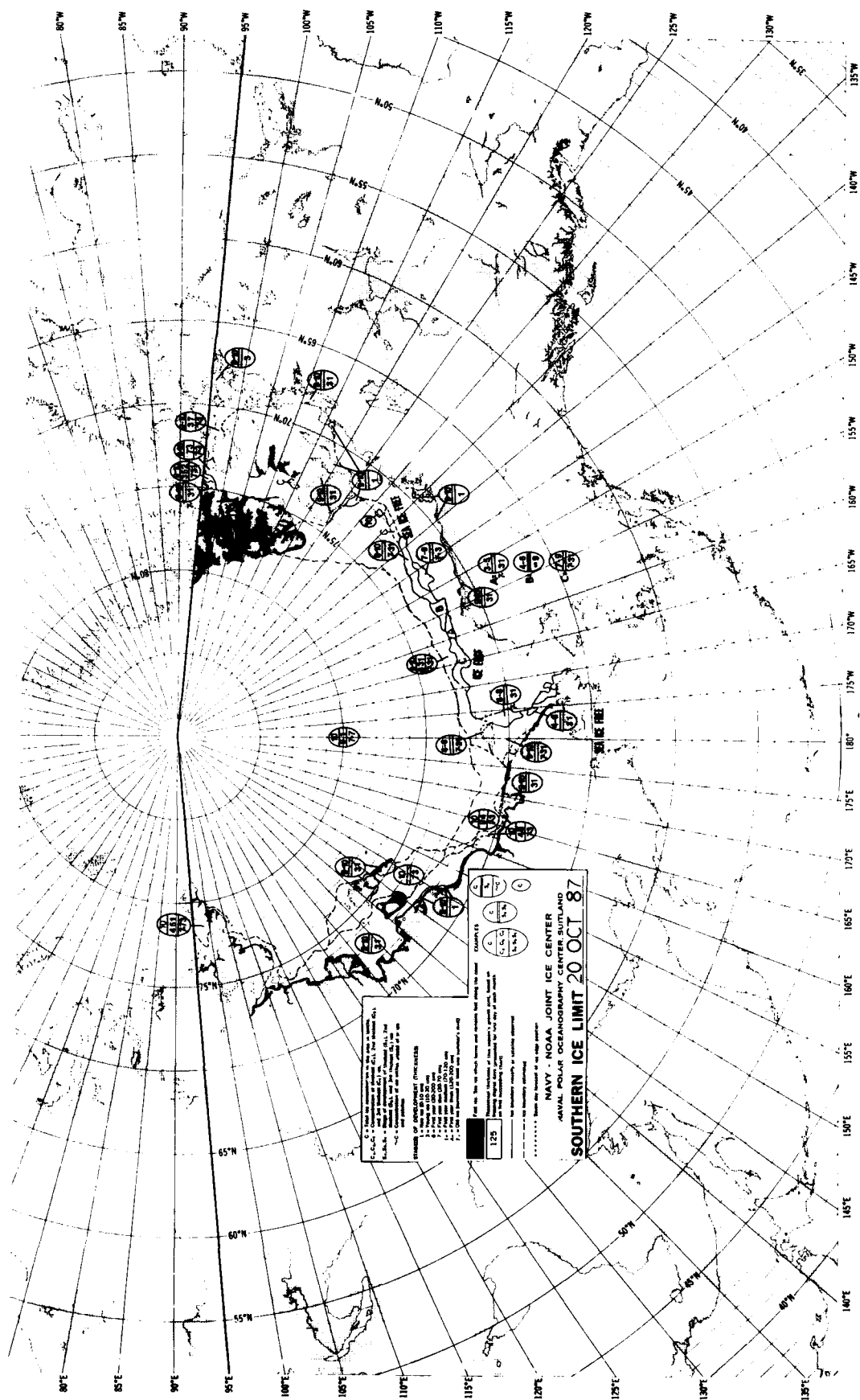


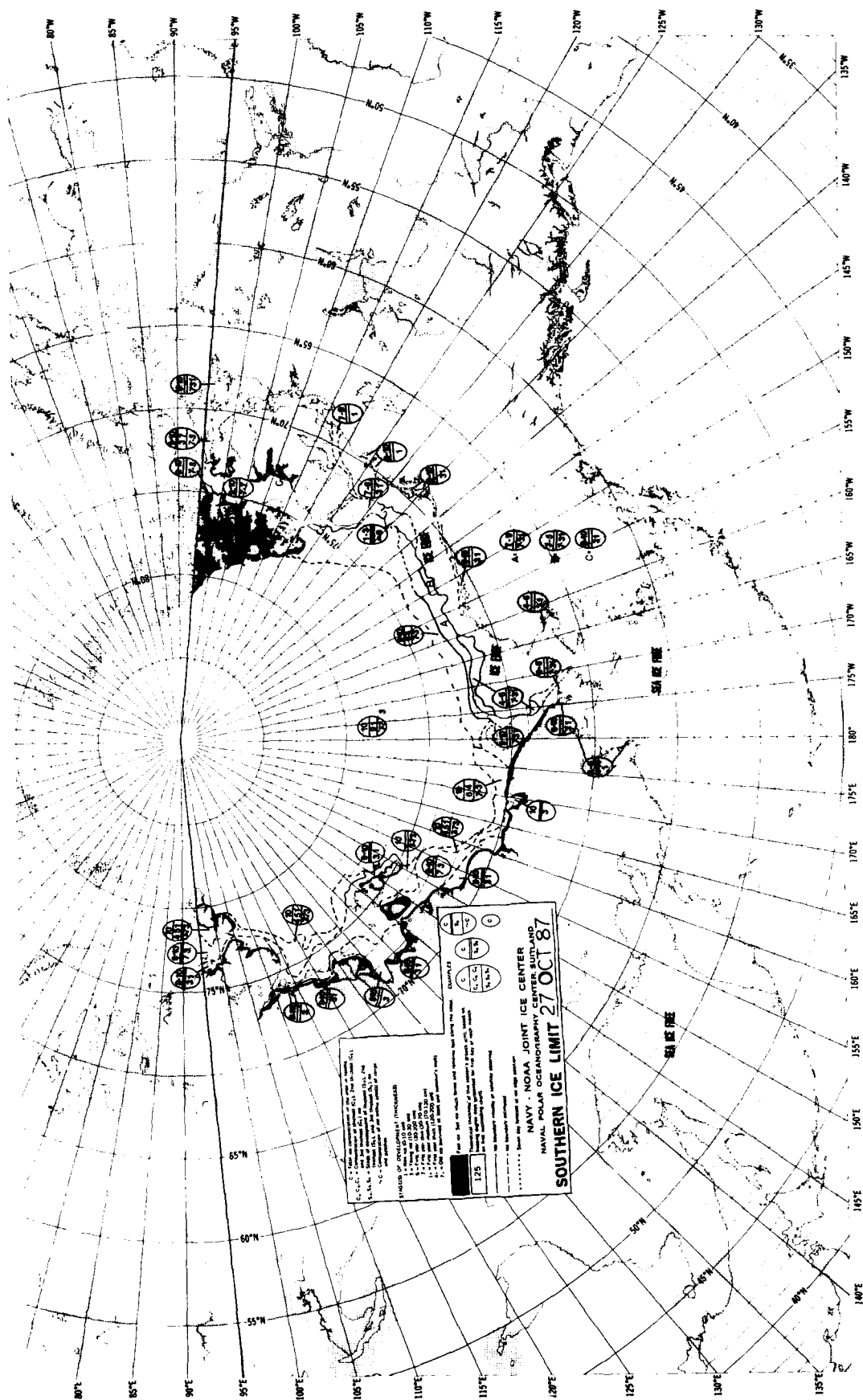
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER BUILDING
SOUTHERN ICE LIMIT 22 SEP 87

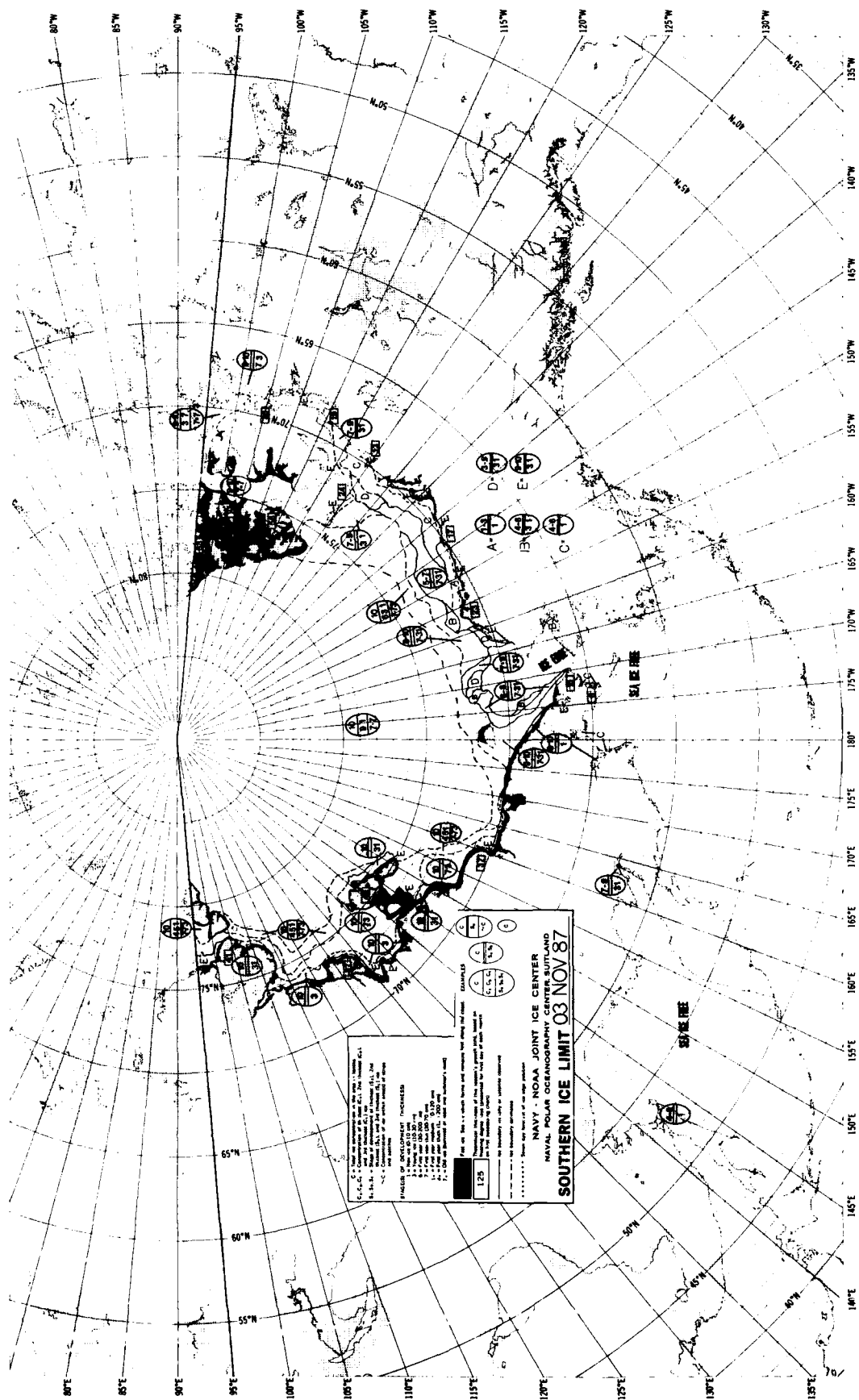


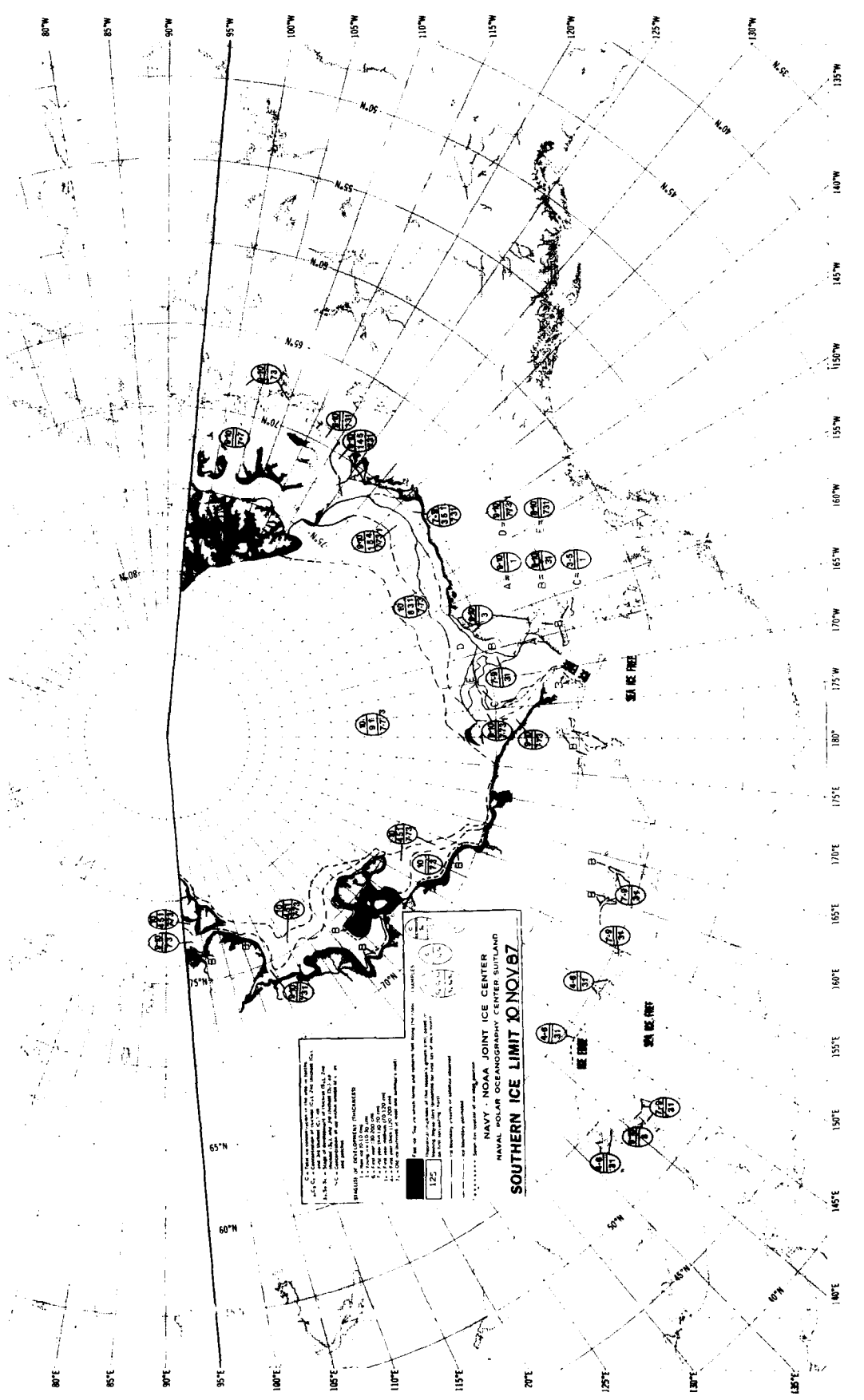




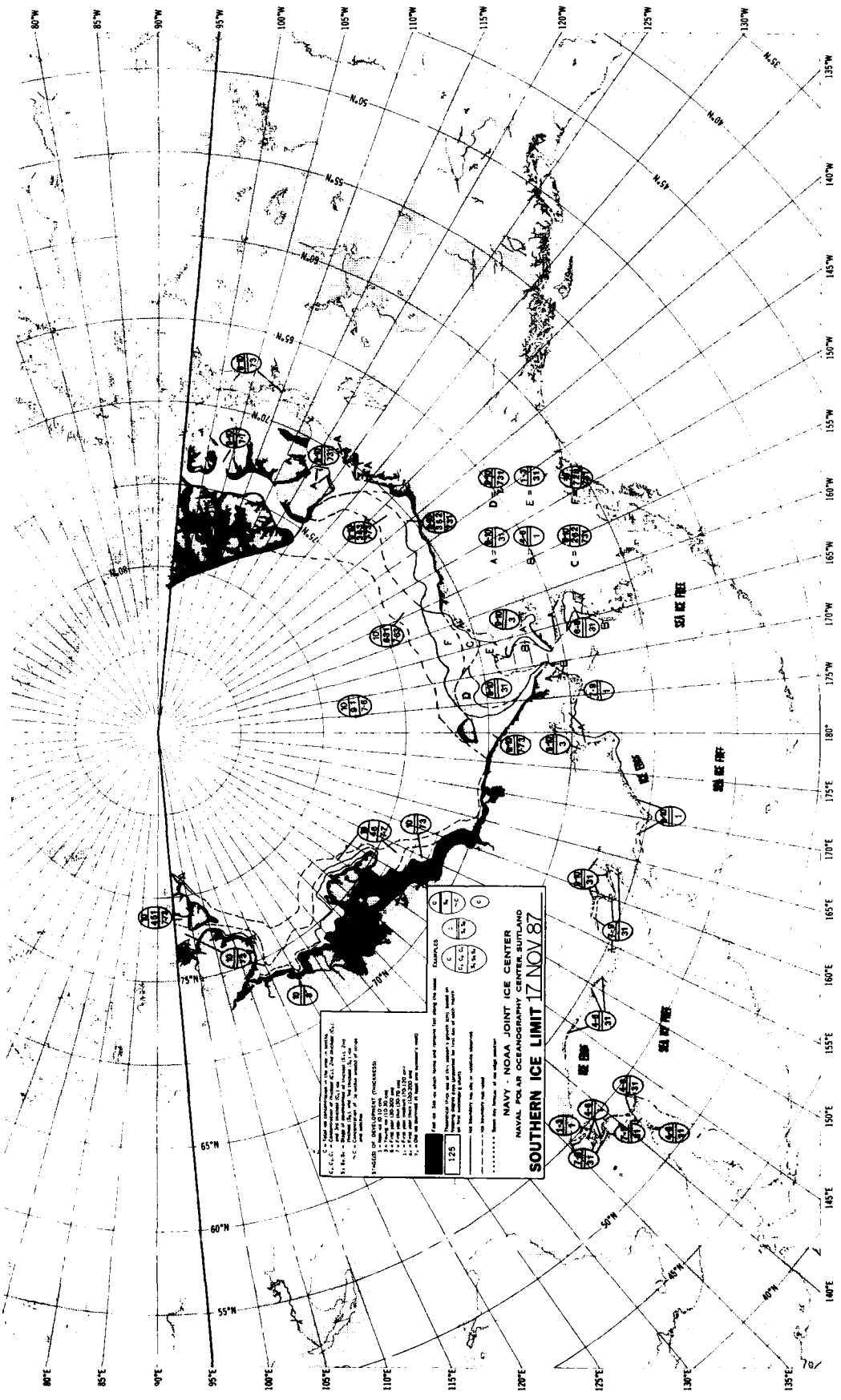


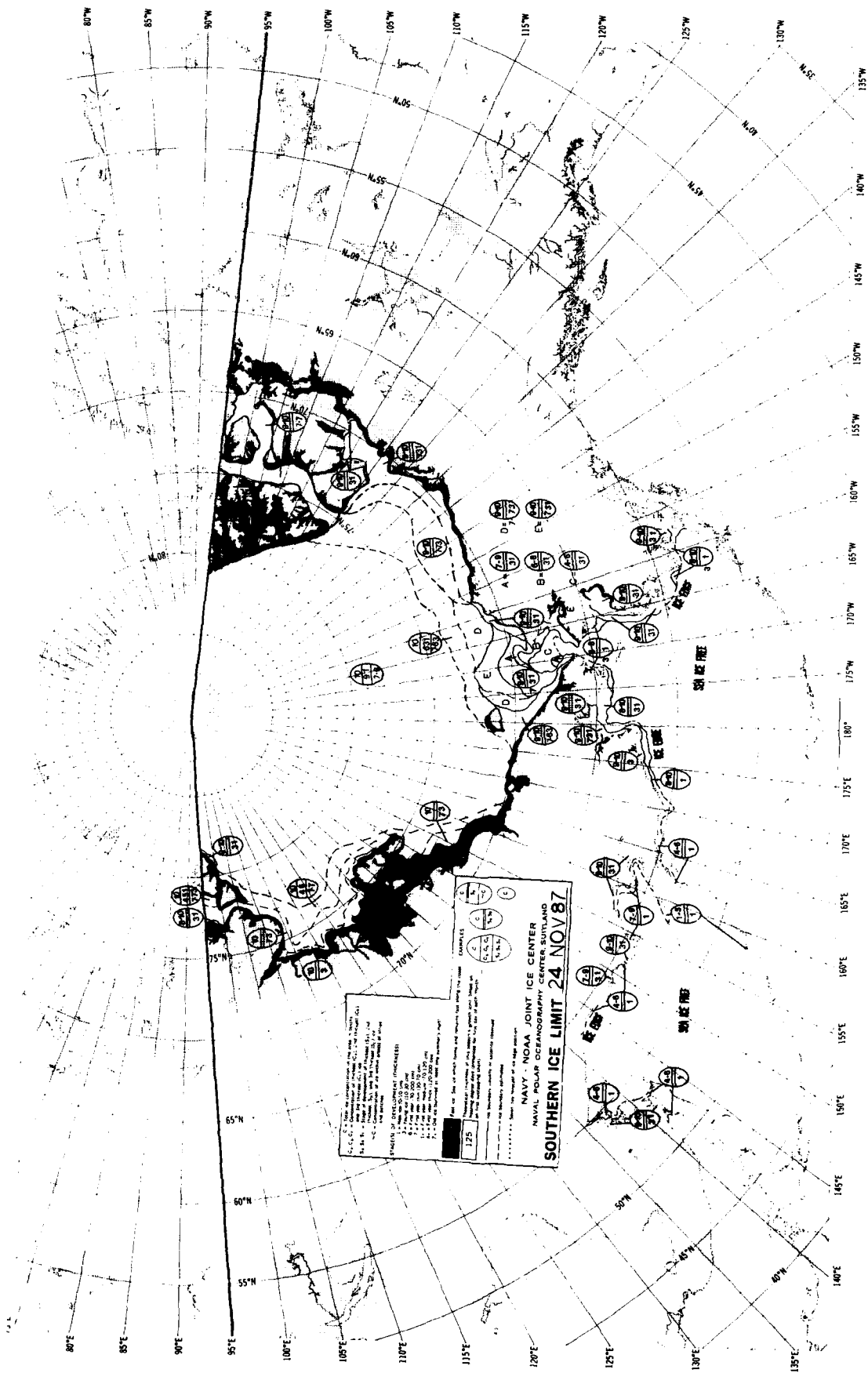


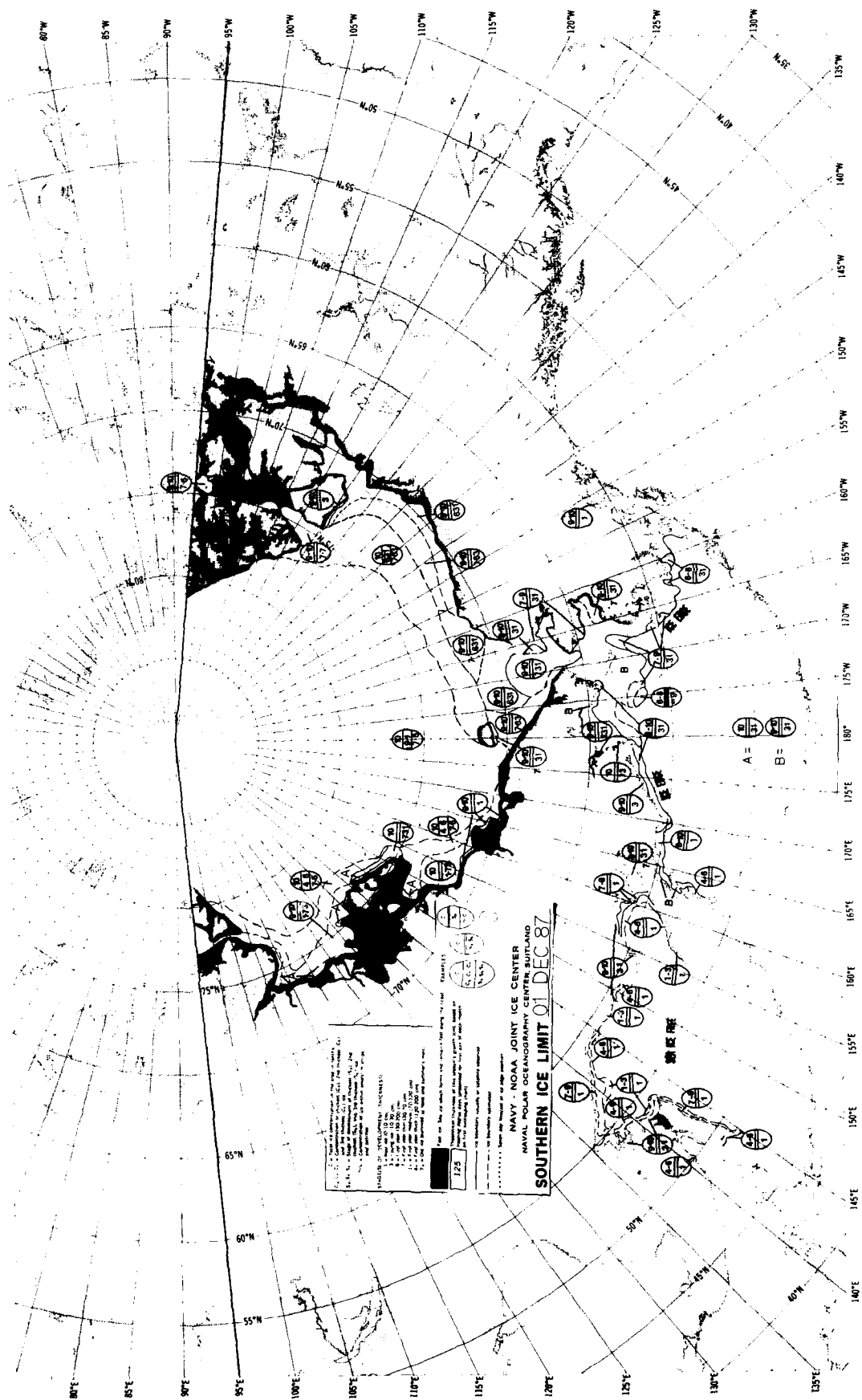


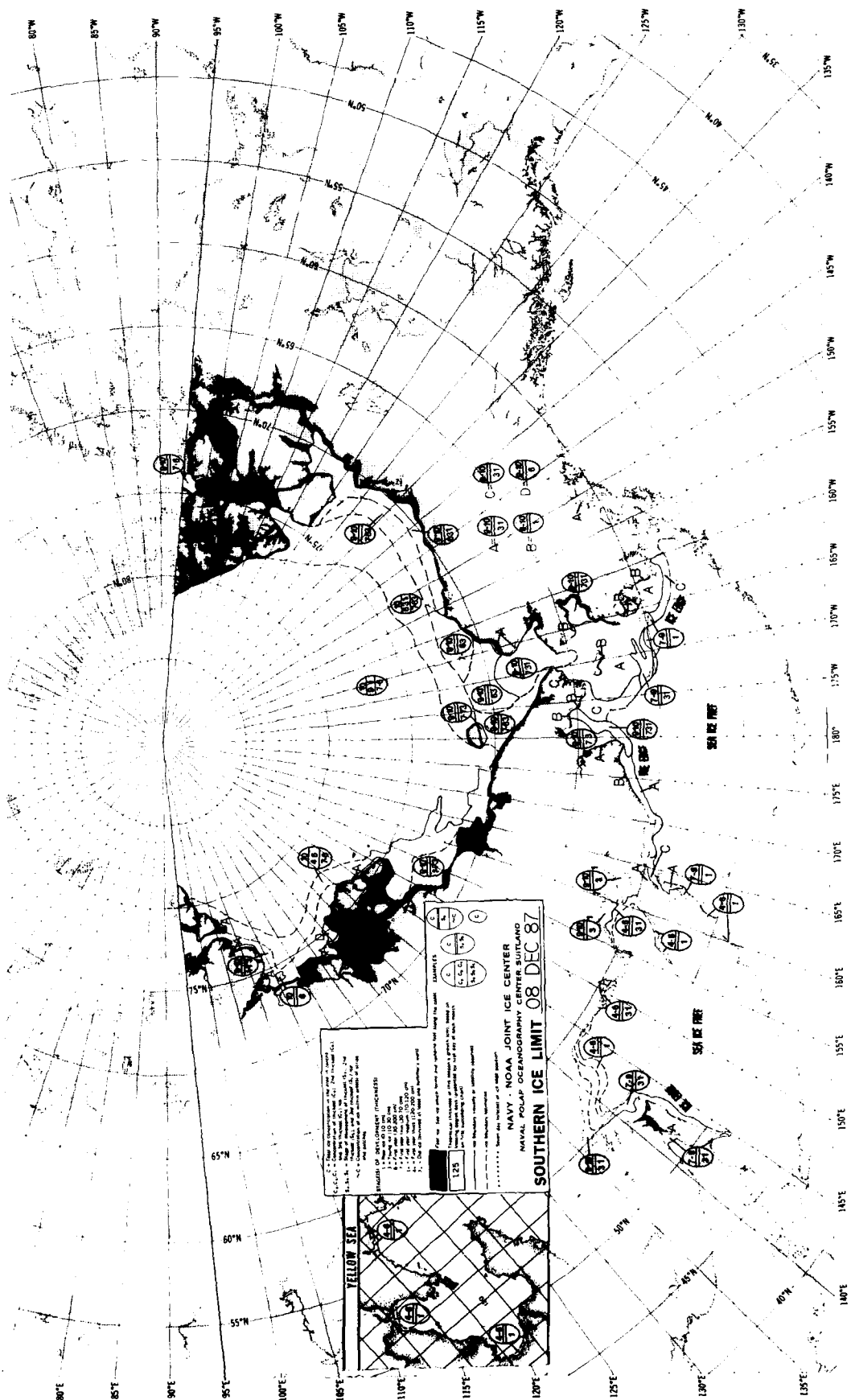


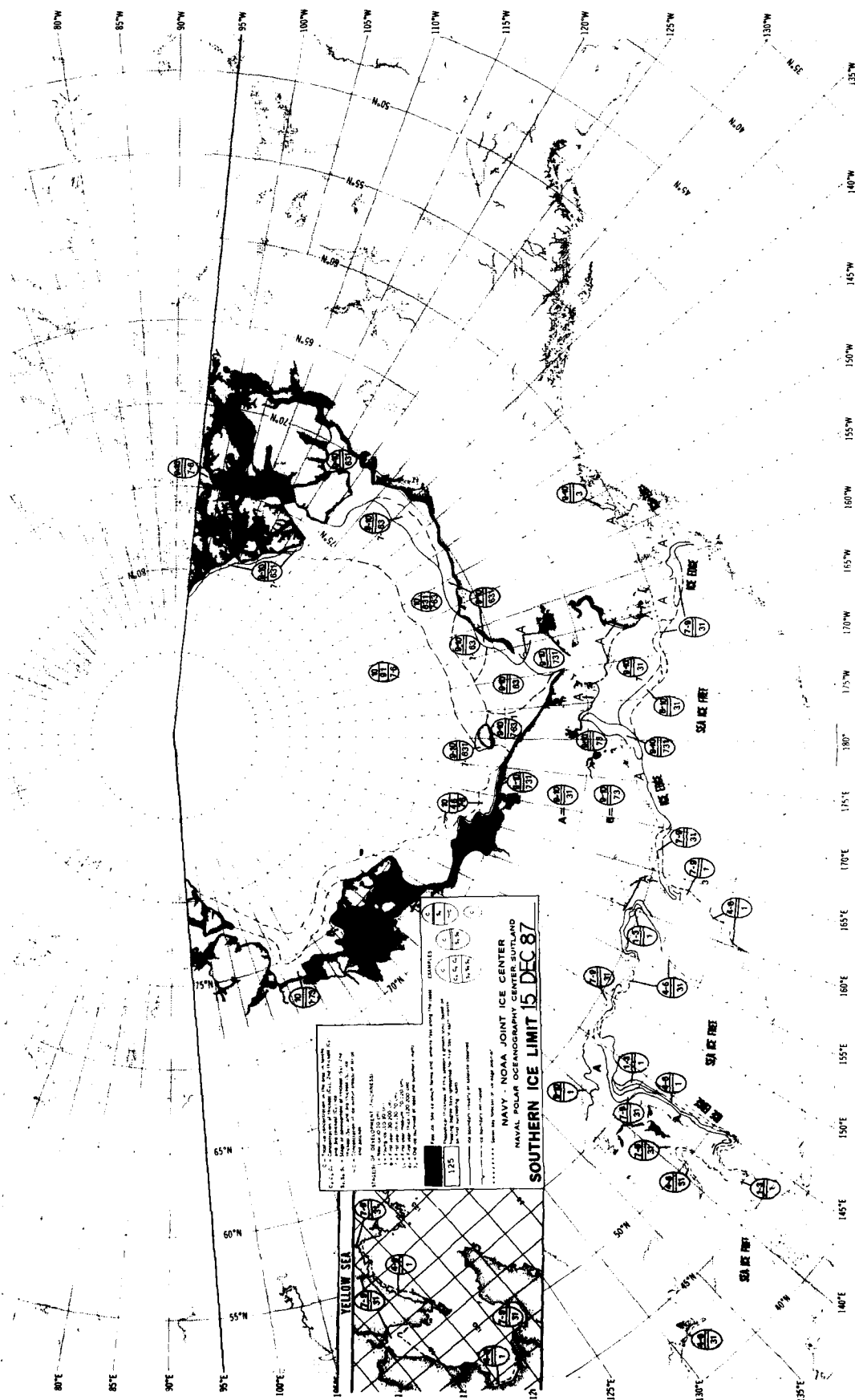
NAVY - NOAA JOINT ICE CENTER
 NAVAL POLAR OCEANOGRAPHIC CENTER-SUTLAND
 SOUTHERN ICE LIMIT 10 NOV 87

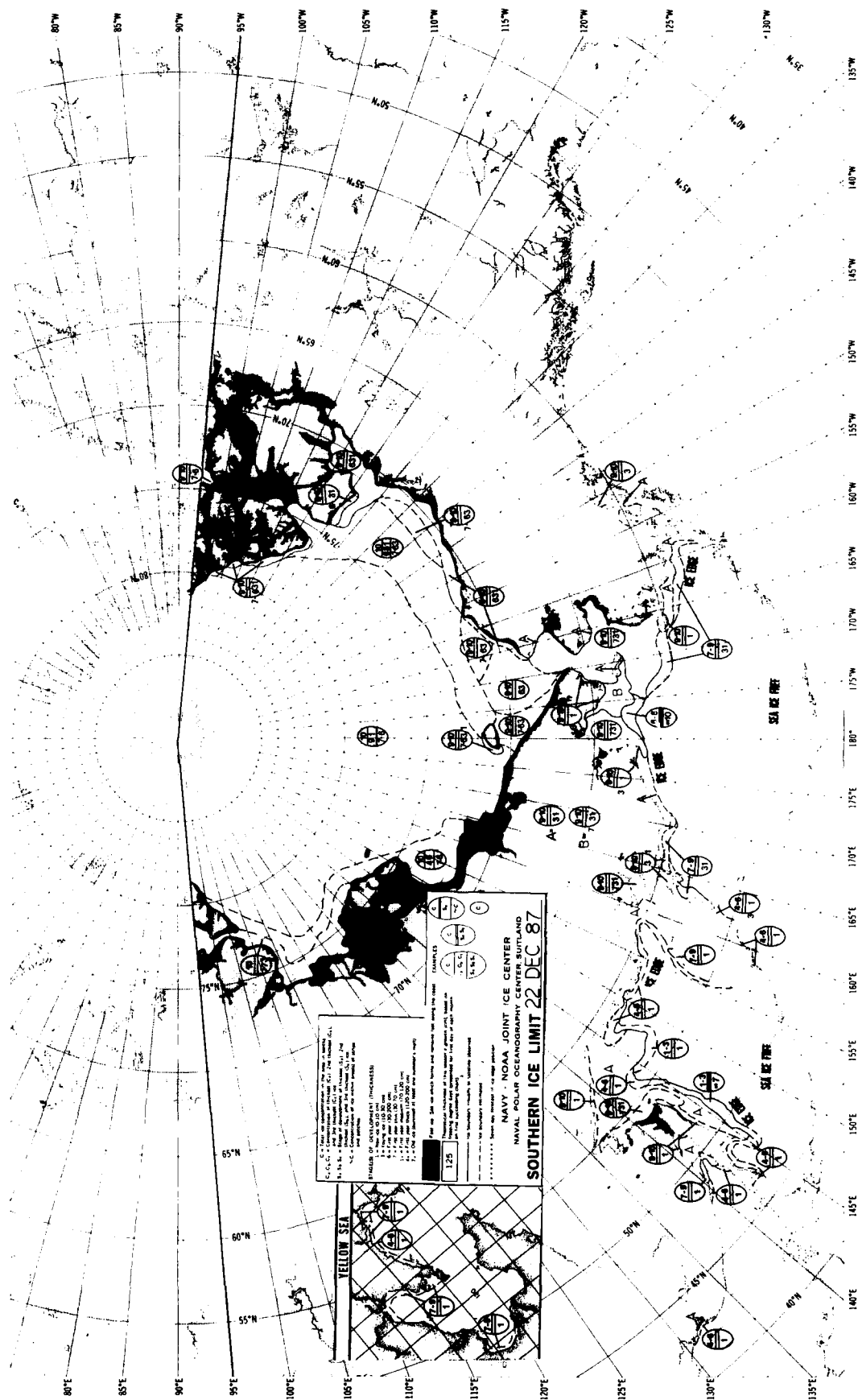












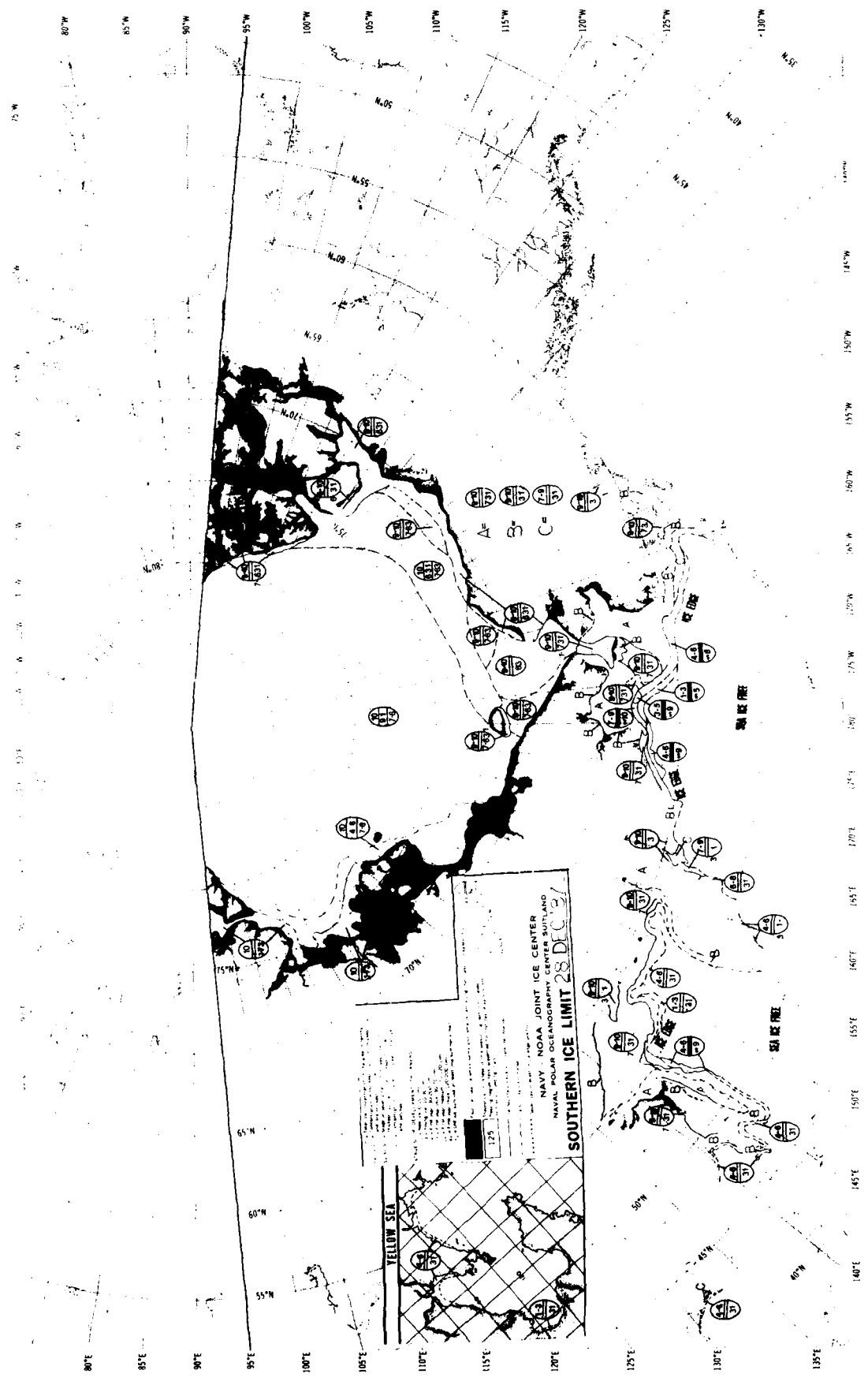


TABLE I. SATELLITE DATA UTILIZED DURING 1987

Time Period		Satellite Remote Sensing			Resolution	Coverage
From	To	Sensor Platform	Sensor Type	Spectral Region		
1-87	12-87	NOAA-9	AVHRR HRPT/LAC VIS NIR IR	0.58-0.68 um 0.73-1.10 um 10.5-11.5 um	1 km	Regional
			GAC VIS IR	0.58-0.68 um 10.5-11.5 um	4 km	Global
1-87	12-87	NOAA-10	AVHRR HRPT/LAC VIS NIR IR	0.58-0.68 um 0.73-1.10 um 10.5-11.5 um	1 km	Regional
			GAC VIS IR	0.58-0.68 um 10.5-11.5 um	4 km	Global
1-87	12-87	NIMBUS-7	SMMR	0.81 cm 1.66 cm	50 km	Global
1-87	12-87	GEOSAT	RADAR ALTIMETER	N/A	7 km	Regional
1-87	7-87	DMSP-F(6)	VIS IR	0.4-1.1 um 10.2-12.8 um	3.7 km	Global
1-87	12-87	DMSP-F(7)	VIS IR	0.4-1.1 um 10.2-12.8 um	3.7 km 4.4 km	Global
8-87	12-87	DMSP-F(8)	VIS SSM/I	0.4-1.1 um 18-87 GHz	0.5 km 50 km	Global Global

Abbreviations and Acronyms:

AVHRR - Advanced Very High Resolution Radiometer
 cm - Centimeter
 GAC - Global Area Coverage
 GHz - Gigahertz
 HRPT - High Resolution Picture Transmission
 IR - Infrared
 km - Kilometer
 LAC - Local Area Coverage
 NIR - Near Infrared
 SMM/I - Special Sensor Microwave Imager
 SMMR - Scanning Multifrequency Microwave Radiometer
 um - Micrometer
 VIS - Visible



EASTERN—WESTERN
ARCTIC SEA ICE ANALYSIS
1987